6 NOVEMBER 1959

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS

VOL 93 No 19 ONE SHILLING

Walter Somers

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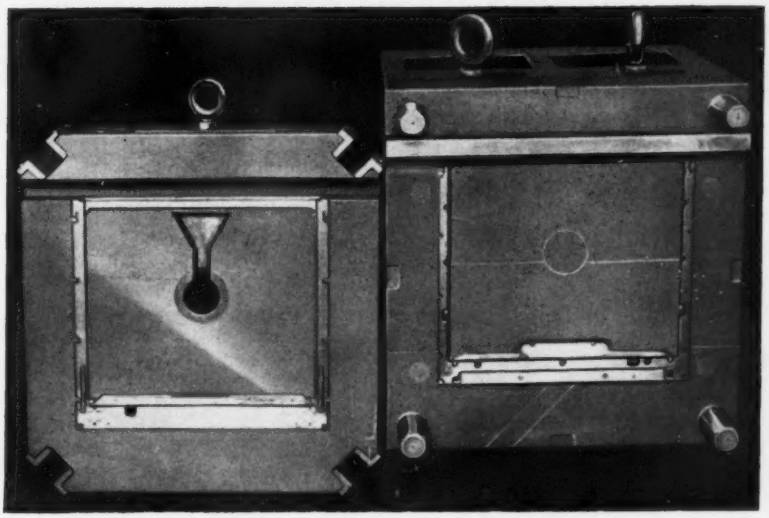

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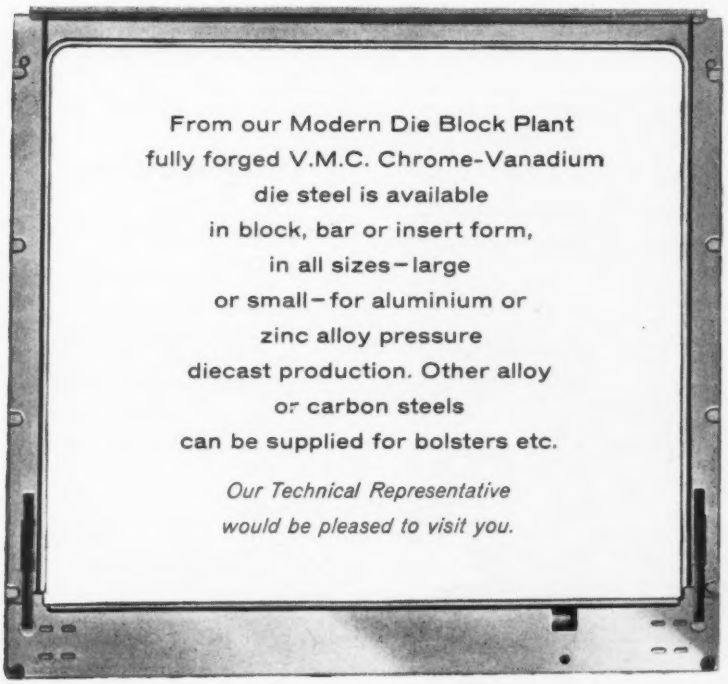

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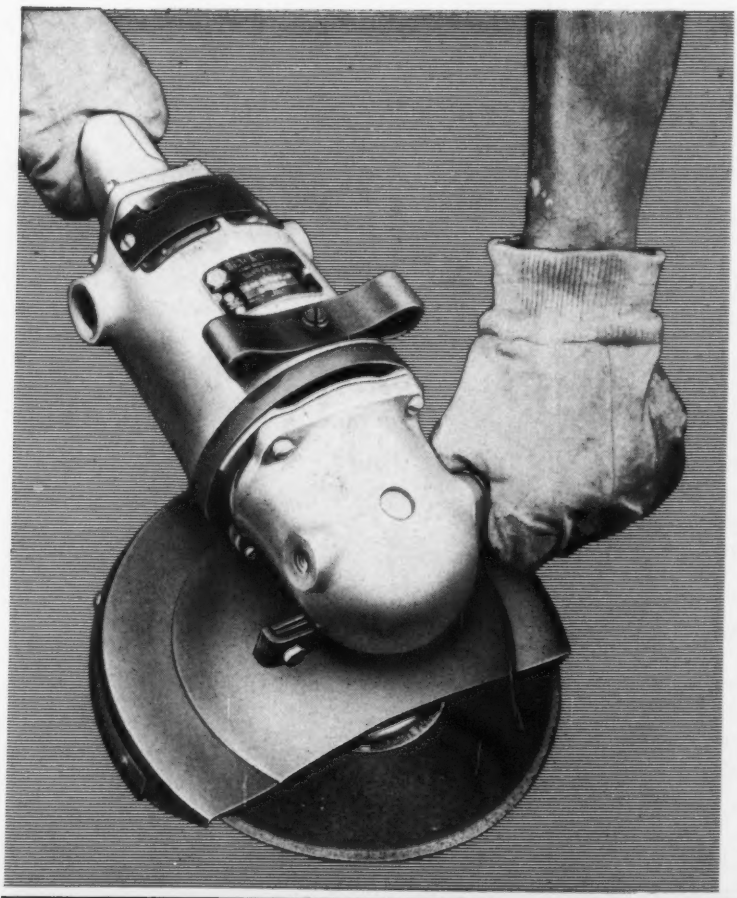

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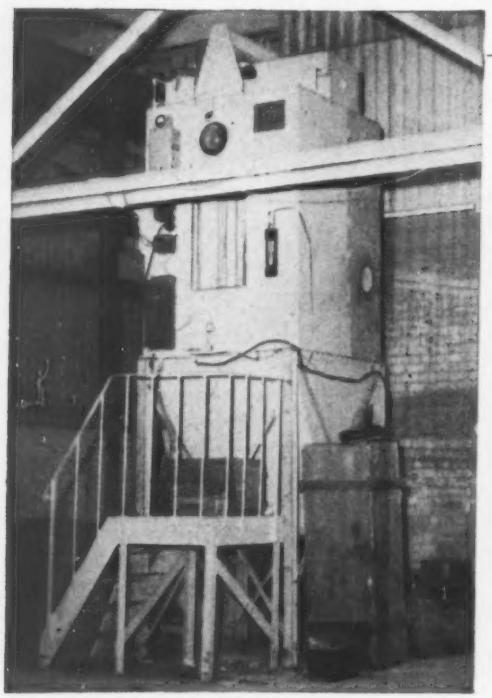

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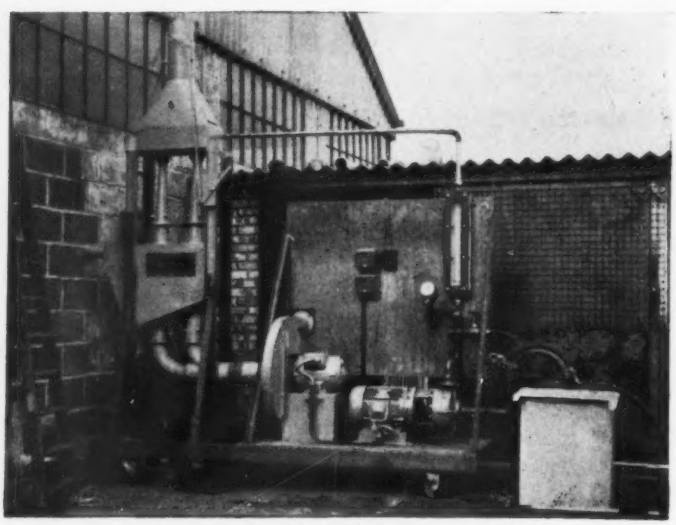

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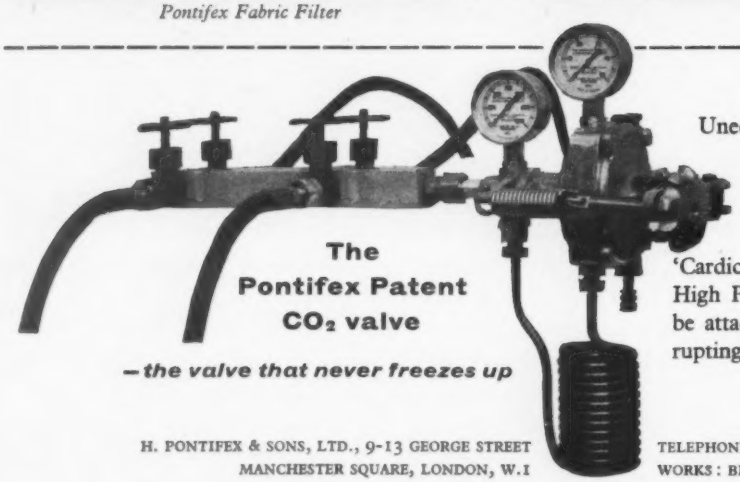

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METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

6 NOVEMBER 1959 VOLUME 95 NUMBER 13

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PUBLISHED EVERY FRIDAY BY ILIFFE & SONS LIMITED

Editorial Offices: 9 Charlotte Street, Birmingham 3 . Telephone: Central 3206

Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Tel.: Waterloo 3333. 'Grams: "Metustry, Sedist, London"

Branch Offices: MANCHESTER: 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595 BIRMINGHAM: KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 26a RENFIELD STREET, C.2; telephone, Central 1265

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METAL INDUSTRY

VOLUME 95 NUMBER 13 6 NOVEMBER 1959

Industrial Trends

DESIGNED to give a general up-to-date picture of the industrial economy, the sixth of the four-monthly enquiries conducted by the Federation of British Industries among a cross-section of industries, and relating to the position at the beginning of October, shows that this time the larger firms are increasing output more markedly than the smaller and that the engineering, metals, shipbuilding, electrical and vehicles industries lead the increases in output. Last June, it will be recalled, 46 per cent of the firms reported output to be greater than in February, and 38 per cent of them were then working to capacity, compared to only 20 per cent in February. In the latest report, output figures have increased for 53 per cent, and 50 per cent are now working at capacity. Both numbers employed and hours worked per operative have increased more markedly than in June. A change of trend appears here; for the first time since the enquiry began more firms find it harder to get the labour wanted than find it easier. But the trend is not strong and the predominant reply is "no change".

This increased output is obviously due to the rate at which new orders are being received, thus 48 per cent of the respondents report an increase and only 11 per cent a decrease; for new export orders only, corresponding figures are 25 per cent and 14 per cent respectively. The indication in June of lengthening order books is this time more marked, 40 per cent reporting an increase as compared with 32 per cent. The level of export deliveries remained the same for 44 per cent and was higher for 27 per cent of the firms, but home deliveries were up in the case of 51 per cent and only 9 per cent reported a decrease. It is consistent with this that the earlier rises in stocks of finished goods (which were checked in June) have now changed to a significant fall. The steady decline in raw material stocks, which was a feature of earlier enquiries, and which was checked last June, now shows signs of changing direction to an increase. Work in progress is reported to remain the same as in June last by 43 per cent of the firms, only 12 per cent recording a decline. Costs per unit of output remain the same for 60 per cent, 21 per cent reporting a rise, selling prices are down in 20 per cent of the cases, while profit margins are less for 33 per cent, only 13 per cent reporting an increase.

In general, the October replies show continuing expansion over a wide front which is expected to continue, thus justifying an optimistic outlook for the future. Unfortunately, there is not as yet a corresponding expansion in the plans for capital investment. The trends differ between buildings on the one hand and plant and machinery on the other. For the latter, the downward trend was checked last June (when higher and lower expectations were balanced) and the present enquiry shows another of the changes to an upward trend, 35 per cent expecting to authorize more capital expenditure on plant and machinery in the next twelve months, which is its most interesting feature. This is not the case for new building—the downward trend, which was lessening in intensity up to June, shows no significant improvement this time, only 24 per cent of the respondents anticipating increased expenditure on this item in the coming year.

Out of the MELTING POT

Calculable

BY contrast with the numerous efforts that have been made in the case of creep, there have been comparatively few attempts to find mathematical expressions characterizing the behaviour of metals subjected to fatigue stresses. One such approach to which attention may be drawn has recently been described by V. S. Ivanova in *Doklady Akademii Nauk S.S.S.R.* The treatment is based on the statement that the work of plastic deformation in the breakdown of a test piece at any value of a symmetrical stress cycle above the limiting fatigue stress is a constant. The difference between this work and the work expended on bringing the test piece to the point at which there starts the formation of submicroscopic fatigue cracks is also a constant. Another evaluation of the mean value of the work performed per fatigue stress cycle, and of the relative change in the work per cycle, is possible on the basis of the mechanism according to which fatigue fracture is brought about by the condensation of vacancies on the tips of the submicroscopic cracks. These two approaches to the work performed in fatigue stressing lead (following a number of simplifying assumptions) to the conclusion that for a group of similar materials (iron and steel, light metals, and so on) the difference between the stress which will cause fatigue fracture after a given number of cycles and the stress which, after the same number of cycles, will cause the start of the formation of submicroscopic cracks is a constant. This constant, referred to as the fatigue constant of the metal, can be determined from the inclination of the straight line obtained by plotting the value of the tangent of the angle of inclination of the fatigue curve (plotted on a semi-log scale) against the logarithm of the number of cycles at which the horizontal portion of the fatigue curve is reached. For iron and its alloys, the fatigue constant has been found to be 6·0 kg/mm^2. Given the value of this constant, the limiting fatigue stress can be determined by determining the stresses required to cause fatigue fracture after several different numbers of stress reversals.

To Profitable Use

GIVEN sufficient time for the necessary enthusiasm to take effect and the preliminary development work to be done, the production of metal parts by deformation brought about by the use of explosives will, no doubt, be adopted on quite a wide scale. Given even more time and further developments, both in methods of fabrication and in the demand as regards the type of fabricated parts and of the materials used for them, some of the capacity for the manufacture of parts by explosive forming will, as manufacturing capacity of all sorts is wont to, become temporarily or permanently surplus to requirements. It is most fortunate, therefore, that already a possible alternative use for the accumulated experience in the industrial use of explosives, and for any surplus capacity that may become available in the future, should have made its appearance. Those concerned might, therefore, wish to make at least a mental note of the fact that, should they find themselves in the future with such experience and capacity going begging, they could then have a shot, almost literally, at using it for manufacturing diamonds from graphite. To do this, the graphite is arranged in a target, and is transformed wholly or partly into diamond by means of high pressures generated directly or indirectly by the explosion of an explosive charge. The latter preferably takes the form of a shaped charge provided with a liner, consisting wholly or partly of graphite. The jet resulting from this shaped charge is directed on to the target containing the graphite, which is preheated to a suitable temperature and which has crystallization seeds, such as splinters of diamond or splinters of a substance structurally related to diamond, embedded in it. As an alternative to the shaped charge of conventional explosive material, the high pressure required in the process may be generated by the "explosion" of a thin conductor through which a discharge from a charged capacitor is passed.

Epilamizing

EPILAMIZING is not exactly a familiar surface treatment process. It is a process intended for treating surfaces of very small bearings, e.g. watch bearings and the like, which have to be lubricated, the purpose of the epilamizing treatment being to render the nature of the surface such that the lubricant applied to the bearing will not spread over the surface beyond the point of application and thereby become subject to more rapid ageing. Epilamizing, as the word implies (or does it?), consists in applying a thin layer of epilam to the surface requiring treatment. An epilam, in this context, is a substance, such as stearic acid, which has strongly polar molecules which adhere with their polar ends to the surface of the article to be epilamized, the non-polar ends forming an inert protective surface. The purpose of this is to protect the lubricant from the action of the metal surface and thus prevent it spreading and undergoing chemical change. The protection against spreading and ageing of the lubricant afforded by epilams is dependent on the thickness of the film which they form, the degree of orientation of the molecules with respect to each other and the surface, the purity of the epilam, and on its adherence to the surface. Because of the small size of the parts that are normally treated and the fact that the mechanism of the effects of epilamizing is operative on a molecular scale, consistent results of the treatment are most important, and hitherto have not been obtainable by methods depending on dipping or coating. Indeed, the inconsistency of the results has hitherto put the utility of the epilamizing treatment under dispute. A recent development, by means of which the best and consistent results should be obtainable, relies on thorough cleaning of the surfaces to be treated and on the subsequent deposition of the epilam from the gas phase. Preliminary cleaning preferably takes the form of ultrasonic cleaning. This is followed by vapour degreasing and then by epilamizing. The latter is carried out with the parts suitably supported in a jacketed chamber heated by, for example, hexane vapour. Hexane vapour in a suitable vessel is also used to heat a U-tube "carburettor" filled with carrier material, such as grains of pumice stone, and the epilam, e.g. stearic acid. A carrier gas, such as carbon dioxide, is drawn through the carburettor and then carries the vapour of the stearic acid, with which it becomes saturated, into the epilamizing chamber, where a uniform film of pure stearic acid is deposited on the parts being treated.

Skimmer

Improving Foundry Conditions

By J. B. McINTYRE,
M.Sc., A.I.M.

[Courtesy Manganese Bronze and Brass Co. Ltd.

Heat, fumes, dust and danger were the common lot of foundrymen until comparatively recent times; this illustration shows a typical scene in a heavy non-ferrous foundry half-a-century ago

INDUSTRIAL working conditions generally have improved greatly during the past half century, and since 1945 rapid progress has been made. These improvements stem from a variety of causes, and include improved location, equipment, and working conditions. In common with other industrial establishments foundries have shown substantial progress and in many ways this has been quite remarkable. Castings production is sometimes regarded as an engineering pursuit, and in other cases as a mainly metallurgical process, but has retained the characteristics of a jobbing industry which are unfavourable to change. Relatively few foundries are fully-mechanized, and small units which employ less than fifty men are common. Iron foundries predominate in terms of output and value of castings made, but there is a large number of non-ferrous foundries in operation also. Despite the apparently endless range of casting designs required and the large number of alloys used, the problems involved in the maintenance of good working conditions are common to all foundries. These are heat, dust and fumes, and noise; the arrangements necessary to secure orderly working in tidy conditions known popularly as "good housekeeping", are of equal value in all industrial units in order to reduce accidents.

Heat

Melting and pouring of metals and alloys are the primary sources of heat generation in foundries, but castings when knocked out or during heat-treatment are responsible for additional rise in foundry temperature. The Factory Acts are concerned, among other things, with adequate working temperature in factory buildings, but minimum temperature requirements are quickly reached in foundries, and it is rapid temperature increase which may be a problem. Wide variations in working temperature can cause similar variation in output, and though modern ventilation equipment is excellent there is an increasing number of people who consider that the solution to this problem lies in close control of the heat at source. Radiated heat from melting furnaces, pouring stations, heat-treatment units and heat generated as castings accumulate at knock-out stations, has always contributed much toward the traditional discomfort associated with foundry work.

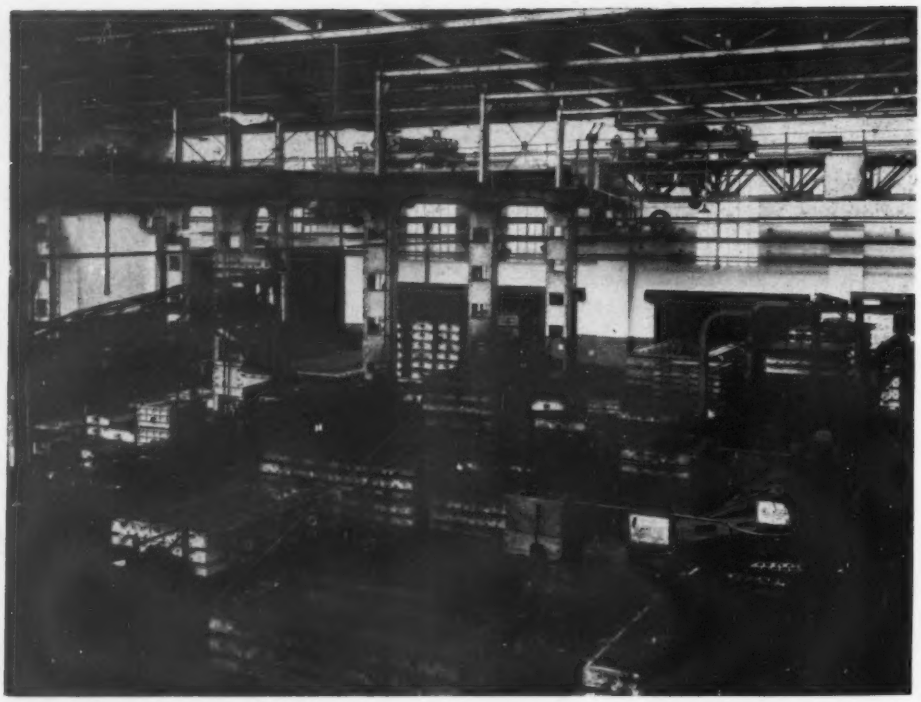
The high melting and pouring temperatures used in steel foundry and in iron foundry practice make working conditions more onerous to the casual observer, but the total amount of heat developed throughout the day in non-ferrous work is also great. In die-casting foundries the problem of radiant heat from furnaces and equipment is not easily solved. In ferrous work, the main source of heat, that developed at the pouring station, is fairly remote from the majority of the foundry personnel; when large castings are made the knock-out stage may be delayed for several days, and the mass of sand surrounding the casting is an effective insulator. Smaller castings are usually knocked out as soon as possible and removed elsewhere. In mechanized work this is essential to maintain scheduled production rates, and, in large scale production, cooling bays are provided in which the hot castings are traversed continually on pendulum conveyors until they can be conveniently handled. Some smaller foundries still indulge themselves in the old practice of moulding, pouring and knock-out in the same floor area, but this is now regarded as undesirable. Dust, heat and fume cannot be prevented completely, but a great deal can be done to limit them. The original suggestion that all foundry operations should be divided into compartments has much to commend it, and the principal dust- and heat-creating activities can, with some thought, be separated from each other. These principles have been adopted in many of the foundries which have been built or re-designed in the past ten years.

Clean Conditions

Section I of the Factories Act (1937) requires that every factory should be kept clean, and the Grinding of Metals Regulations (1925) indicate that rooms used for the cleaning of castings should themselves be regularly cleaned. The industrial cleaning methods which originated in Scandinavia have much in their favour, and are likely to be more widely used in future. Clean foundries are those in which measures are taken to maintain standards thought worthwhile. Cleanliness, like purity, is to a large extent dependent upon personal conviction, but not all foundries have awaited legislation before meeting quite high standards in this connection.

One mechanized foundry in Birmingham, making light iron castings for electrical work, has for more than 20 years regarded clean and tidy buildings and equipment as vital factors in production. Several men are employed on a full time basis to operate a complete schedule for foundry cleaning and painting. For many years, double shift working has been the practice in this plant, and the management are convinced that the arrangements outlined here are also economically desirable. Foundries which specialize in the production of heavy castings are usually jobbing in character and have inherited some of the traditional practices of loam founding. Dust is sometimes regarded as inseparable from dry sand moulding, but a great deal can be done to reduce the difficulty.

In Rugby, large iron castings have been made by one company for very many years, and more than ten years ago the company concerned decided to secure the combined benefits of colour and cleanliness by tiling the foundry walls. White tiling extends from roof level to within several feet above ground, and red tiling below. This surface is designed to facilitate regular cleaning and serves the purpose admirably. In addition, the excellent



[*Courtesy English Electric Co. Ltd., Rugby*

Tiled walls, good lighting and planned layout facilitate the maintenance of clean conditions in this large iron foundry

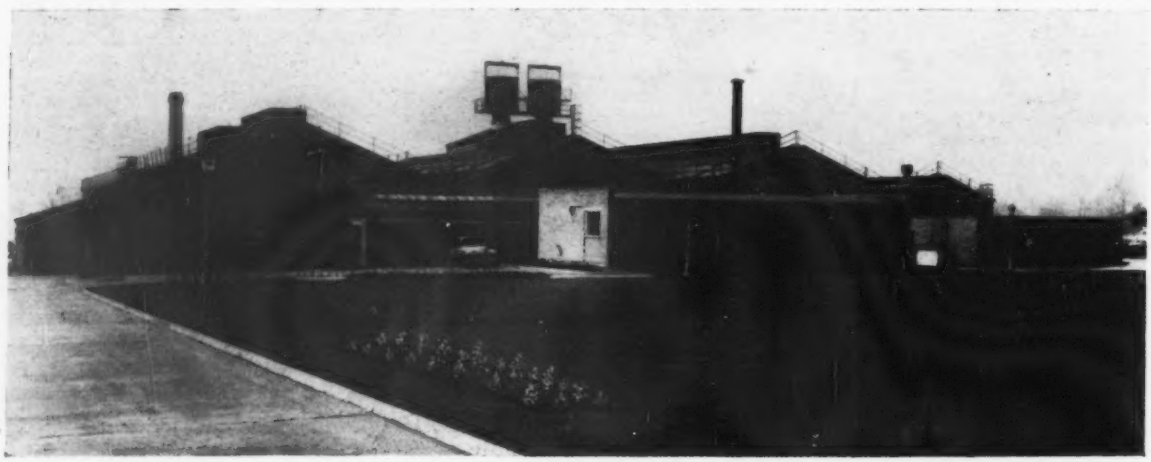
lighting arrangements which are installed tend to be more efficient under such conditions. Some of the dust and fume generated in iron foundries is due to the coal dust extensively used as an addition to moulding sand. Limited trials using wood resin as an alternative to coal dust were carried out some years ago and a considerable improvement in working conditions resulted. The short service life of such sands is a major obstacle to their wider application, but there is no doubt that if coal dust were more expensive it would be used in a more controlled fashion and some improvement in working conditions would then be found in a number of foundries. Additions made to moulding and core sands also include wood flour, various oils and cereals, synthetic resins, and sulphur, all of which tend to produce fume rather than dust. None of the fumes generated is pleasant, and some are objectionable. It is likely that many of the oil sand cores used in jobbing work are overbonded, and more fumes generated than need be.

In 1945, the then Chief Inspector of Factories set up a Joint Advisory Committee on Conditions in Iron-foundries; this was designed to improve the appearance of iron foundries through better cleanliness and the use of more light and colour. In addition, improved atmospheric conditions, better amenities and more comfortable working conditions were recommended. Atmospheric conditions in steel foundries had already been examined by another advisory body set up in 1943, and though the terms of reference were not the same, much common ground obviously existed between the work of this body and that of the iron foundry committee. In 1953 there appeared the Iron and Steel Foundries Regulations which made provision for the safety, health and welfare of persons employed in the industry. These regulations outlined requirements for safety and cleanliness in work places, prescribed measures for the suppression of dust and fumes, and dealt with clothing accommodation, bathing facilities, and protective equipment.

Non-ferrous foundries are not covered by either of the reports concerned with ferrous castings production, but a Joint Standing Committee

A re-built foundry provides scope for improving surroundings

[*Courtesy Chamberlain and Hill Ltd.*



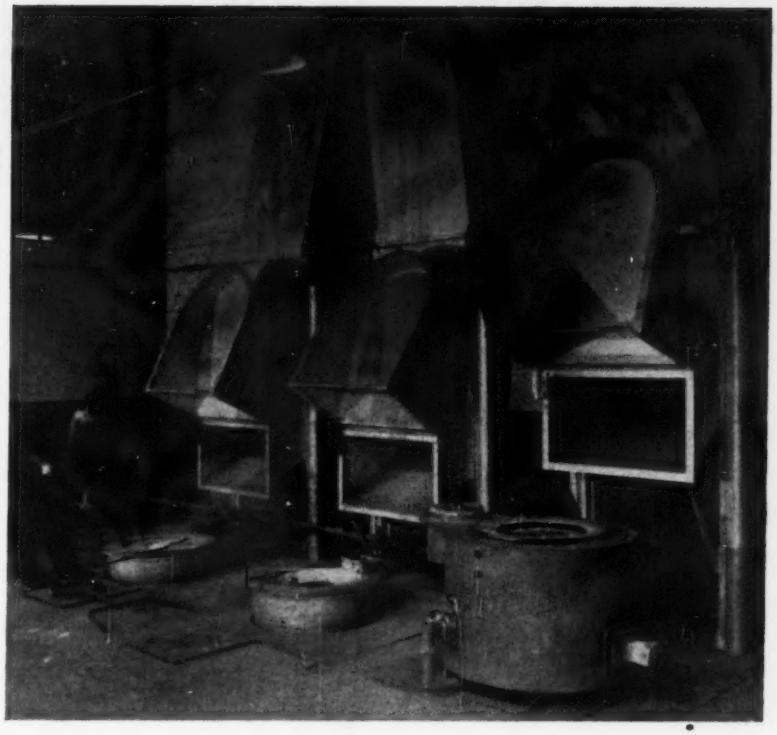
on conditions in non-ferrous foundries was organized, and all three committees now work together in the closest possible fashion. Regulations dealing with non-ferrous foundries are now in draft and will, no doubt, appear in due course. It is likely that they will in the main follow the recommendations made for ferrous work, with additional sections of specific interest to non-ferrous founders, such as some revision of the "Casting of Brass Regulations".

Noise

Noise has been described as "sound out of place", and the effects of noise command increasing attention. There is no legislation which restricts noise within foundries, but there are many sources of such noise. Moulding machines and furnaces are notable in this connection and some of the larger coreblowing machines are also quite noisy in operation. Equipment operated by compressed air need not be noisy if due provision is made for silencing, but this is not carried out in all cases. Fettling operations are always noisy but much may be done to insulate the remainder of the foundry from the noise. One well-known foundry in the Midlands has tackled the problem so energetically that the inspection department is located next to the fettling department, and the well-insulated dividing wall between them allows normal inspection to take place in very quiet conditions. In contrast, one equally well-known automobile castings plant on the Continent is so noisy that the personnel are provided with cotton wool ear plugs. The psychological effects of noise are being closely examined, but safe limits have not yet been established. There seems to be no doubt that accident rates go up when noise levels are high, and abrupt change in the amount of noise developed is particularly damaging.

Dust Dangers

Free silica is acknowledged to be the agent most dangerous to workers in a dusty environment, though other types of dust may also be a source of trouble. Sand blasting has for very many years been replaced by metallic grit and shot blasting, and the introduction of wet cleaning methods for larger castings has done much to simplify this arduous work. In moulding operations the traditional parting sand or powder was invariably siliceous, but such materials have been prohibited in this country since 1950. Talc and similar materials have long been used as parting agents in light alloy foundries, and long term investigations have been organized to assess the effects of these agents. Extremely valuable investigations into dust measurement and control have been carried out by the British Cast Iron Research Association, and by the British Steel Castings Research Association. All fettling operations have been closely studied, and all stages of castings production also; the work



Melting and fluxing magnesium alloys. This modern fume extraction installation, with tilting hoods over the furnaces indicates what can be achieved to improve conditions in light alloy foundries where, in many instances, fumes are particularly obnoxious

[Courtesy H. M. Hobsen Ltd., Wolverhampton

[Courtesy H. M. Hobson Ltd., Wolverhampton

Fume hoods over a pouring station for magnesium alloys

continues and must be of great value to the foundry industry. Emissions from furnaces and similar plant depend upon the charge materials and the precise techniques used in operation. Zinc oxide loss during the melting and pouring of brass is very difficult to prevent, but due attention paid to ventilation has made the "zinc fever", which was so common forty years ago, virtually unknown today. So-called cadmium poisoning is quite distressing, but was formerly thought to have no permanent effects. Recent work tends to show that long term indisposition can result from prolonged exposure to this element. Oxygen lancing techniques are increasingly popular in steel melting for castings production, and add to the general problems of ventilation. The emissions from furnaces are often of greater importance to residents in areas adjacent to foundries than to the works personnel. The Black Country is notorious for industrial pollution, but changes from raw coal to pulverized coal, oil, or electricity have helped to reduce considerably the discharge of dust and smoke into the surrounding atmosphere. Zoning to comply with the requirements of Clean Air legislation has stimulated the development and installation of spark arresting and dust catching equipment. Several firms have made great progress in this connection, and much credit is due to them for their efforts. One example of pioneering work in this matter is that of a firm of iron founders who, in 1946, decided to build a new foundry behind an existing plant which was located in a residential area. When this was done and the equipment transferred, the old buildings were demolished and the site converted into excellent lawns and a rose garden which now make such a pleasant approach to the foundry and office block. This striking change from traditional to modern conditions has been achieved mainly by intelligent planning. Moulding, pouring, and knock-out of green sand moulds have to a large extent been segregated, and shell moulding used where economically justified. The results have vindicated the original decision to move the foundry, and the industry generally will profit by it.

Fumes from Shell Moulding

New techniques such as shell moulding and CO_2 moulding have made some contribution toward the improvement of foundry conditions. CO_2 cores do not present the fume problem associated with oil sand, but shell moulds and cores have their own difficulties. Shell moulded castings are frequently small in size, and the weight of metal may not be large enough to destroy the shell mould completely; unpleasant fumes can then be evolved and though not regarded as hazardous, are rather objectionable. Knock-out difficulties do not exist, and fumes are the main trouble. The problem can become substantial in plants making large numbers of shell moulded castings, where the assembled moulds are laid out for casting on roller track or similar conveyors. In one original solution to this problem a large firm of bronze founders in Birmingham have installed special equipment for the purpose, the design of which is based upon the well-known continuous core stove. Assembled shell moulds are placed upon racks within the pouring unit and are poured quite comfortably at floor level. The operators are not exposed to radiant heat or resin fumes as each rack of poured moulds is immediately

[Courtesy Manganese Bronze and Brass Co. Ltd.

A modern jobbing foundry for medium and heavy non-ferrous castings

raised into the cooling area. Adequate exhaust arrangements are provided, and the solid castings are discharged from the top of the unit, passing downward on a conveyor to a collection station.

Other Fumes

Though much emphasis is placed upon dust control in foundries, fumes cannot be disregarded as a source of annoyance, or of positive danger in extreme cases. Carbon monoxide ranks high on the list of dangerous fumes since it cannot readily be detected and quite small concentrations of this gas can be toxic. The coke braziers formerly very popular for local heating and for mould drying are no longer acceptable for these purposes in modern foundries. All coke burning equipment is now treated with greater respect, and acknowledged to be potential sources of gas leakage unless given adequate maintenance. In light alloy castings production quantities of chlorine and of sulphur dioxide may be generated, but the extremely irritating nature of these gases renders normal working conditions impossible before a toxic concentration is reached. Ventilation arrangements in light alloy foundries are always excellent, and the general standards reached are high. In die-casting, notably pressure die-casting, the surrounding atmosphere is frequently unpleasant, due to the combined effects of radiant heat and fumes. Heat from the dies is added to that radiated from the melting units used, and when the latter are oil-fired, sulphur dioxide fumes can often be detected. Oily die dressings are commonly used and also contribute toward an unpleasant atmosphere. Many Continental plants use electrically-heated melting units; these are quiet in operation, capable of holding metal at minimum temperature, and also not liable to fume generation. Such furnaces are now available in this country and when fitted with refractory covers which float upon the molten metal surface, represent substantial progress in the metal melting field.

Many new foundries have been built during the past half century, and several examples could be quoted where far sighted management has produced good layout with good working conditions. War-time black-out conditions stimulated interest in both lighting and ventilation problems, and the post-war years of expansion have afforded opportunity for whatever improvements were thought necessary. A large non-ferrous foundry in Birkenhead is an excellent example. Traditional loam moulding foundries were surely not pleasant places in which to work, but have now been replaced by new buildings designed for sand-cement techniques. The latter are very much cleaner than loam, and require adequate ventilation for maximum efficiency. Large scale electric melting has replaced many of the older reverberatory furnaces, and the net result must surely be a source of great satisfaction to those responsible.

Accidents

The accident rate in foundries is less than that of a few years ago, but is still regarded as unduly high. The pattern of accidents remains fairly standard in that the main causes remain unchanged; burns from molten metal, abrasions and other injuries due to falling objects, and injuries due to poor lifting methods are still the main factors in accidents. Protective clothing is now made available to all personnel thought to be in need of it, but the principal difficulty is that this clothing may not be worn regularly. A feeling of false security may result, and some injury may then be sustained. This is sometimes the case when goggles or protective glasses are laid aside during grinding operations or when molten metal is handled. Training sessions for young foundry workers are now organized, so that they may learn the best methods for lifting and handling heavy and awkwardly-shaped articles; when linked to instruction in general safety principles it is likely that this scheme will substantially reduce foundry accident rates in future. A great deal of time and effort has been devoted toward the general improvement of foundry conditions, and there is now some justification for the slogan adopted by the American Foundrymen's Society—"The foundry is a good place to work".

Swaging Thin-Walled Super-Alloy Tubing

FOR swaging high-strength, heat-resistant alloy tubing a new cold draw forming technique has been developed by the Boeing Airplane Company, Seattle, Washington, U.S.A.

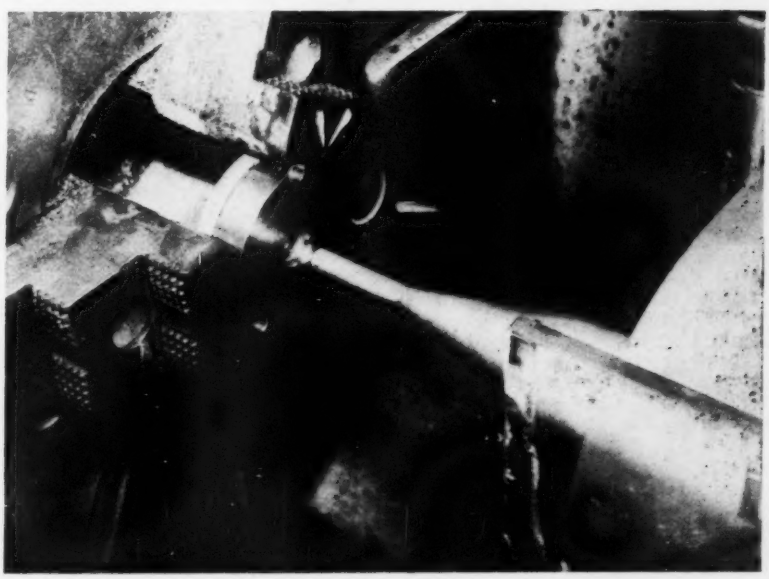
The problem was to reduce one end of a 2 in. diameter, 0·1 in. wall welded M.252 tube down to ½ in. diameter. M.252 is a high-strength, heat-resistant alloy containing nickel, chromium, cobalt and molybdenum. It is difficult to form in cold-working applications, but potentially very useful.

Designed for a structural application in anticipated hypersonic vehicles in which the structural members had to be joined, the 2 in. diameter tubing was necessary to provide maximum support with minimum weight. Because of weight limitations, the tubing wall could be only 0·1 in. thick.

Ordinary joining methods, such as welding, clamping, riveting, sleeving, compatible with heavier materials such as stainless steel or aluminium, would collapse the 0·1 in. M.252. To permit any type of joining, the wall thickness had to be increased at least 300 per cent, without increasing the overall weight. The size of the tube had to be reduced to permit several structural elements to be joined in several different planes at a single point. Both of these requirements could be met by decreasing the diameter of the tube at the joint.

Basing their investigations on the theory that any material properly contained or restrained can be formed to any desired shape and size, Boeing engineers studied known swaging methods and existing equipment. From

Standard Vail No. 7 tube end former lathe used in the Boeing swaging technique



these studies it seemed possible that the job could be done by draw forming, if a way were devised of supporting the tube from the inside to prevent collapse while it was being forced through the die.

It was decided, therefore, to nest aluminium tubing inside the M.252 tube, to swage both at the same time, then remove and discard the aluminium. Past performance guaranteed that the aluminium would not collapse during reduction and it was considered certain that this would prevent the M.252 from doing so. Nevertheless, improper annealing, under-forming or over-forming could cause other things to go wrong. For instance, the tube could buckle, crack, wrinkle, bulge or flare and, during the weeks of testing, all these things did happen.

Finally, an 8-stage reduction with inter-stage anneals produced the first successfully swaged 0·01 in. M.252 tube with a 2 in. diameter at one end and smoothly tapered to a ½ in. diameter at the other at an angle of 10°. Reducing the size of the tube increased the thickness of the metal by 330 per cent.

A standard Vail No. 7 tube-end-former lathe was used as a power source in this initial development with conventional drawing dies of Amco bronze.

An alternative process was also developed for seamless tubing employing a button die. This process entailed rotation of a three fluted die at approximately 300 r.p.m., with the tube being fed into the flutes. The action of the flutes caused reduction much in the same manner as kneading bread dough.

Lead—125 Years

JUST over 125 years ago, William Patrick Grey bought the lease of the City Lead Works in Camomile Street, London, and was soon after joined in the venture by George Marten. So the business of Grey and Marten Ltd. was established. The story of its early vicissitudes is too detailed for inclusion here, but its growth has been steady and the family names of Grey, Marten, and, later, that of Gandy, have been closely associated with it.

Trade was built up on lead for plumbing and associated trades and the company laid down the first hydraulic press in the City of London for the extrusion of lead pipes, and their recently installed equipment is still well to the fore among current developments. In 1880-81 the business was transferred to the Southwark Bridge Works, and in 1898 the firm became a limited company with E. W. Gandy as its first chairman.

The lead trade suffered heavily around the turn of the century and this led the company to encourage the formation of a lead manufacturers' organization, which later became the Lead, Sheet and Pipe Manufacturers' Federation, and which also helped the formation of the Lead Development Association.

In the early years of the century, the solder business grew and the firm still produce some solders under the same brand names and specifications that prevailed at that time. Developments during World War I, and the growth of the electrical, telephone and radio industries created a demand for non-corrosive fluxes for soldering, and in 1919 the firm started extruding solder wire with a core of resin as flux.

Subsequently, demands within the aircraft industry led to even tighter specifications for many materials, and as early as 1924 the firm was approved as A.I.D. suppliers. The motor industry, as it also grew, consumed increasing quantities of solder and the Grey and Marten business developed accordingly. In 1930, a branch office was opened in Birmingham, and a factory began operating there in 1938.

The company celebrated its centenary in 1933, and trade was consolidated during the pre-war years. After the war, in 1946, the firm acquired the business of Andrew Gray and Company, of Glasgow, their works was modernized and the position of the two firms strengthened.

One aspect of the early dealings with the plumbing trade was that a plumbers' merchants business was set up, ultimately serving London and East Anglia with all plumbing, glazing and similar supplies. In 1954, trade in the north had developed to the point where a local office was needed in the Manchester area, and Lancashire, Yorkshire and Ulster are now served from Altrincham.

With the growth of the chemical industry and, later, developments in X-rays, a demand for acid-proof containers, coils, filters, and for lead shielding grew up, and the firm entered these fields at an early stage, manufacturing equipment to customers' requirements.

Experience in this field led naturally to the production of lead shielding for nuclear applications, and in 1957 the lead foundry of James Girdler and Co. Ltd. was acquired, a lead protection department being set up to deal with this aspect of the work.

In 1958, the company began the extrusion of polythene water pipe, together with fabrication of plastics of all kinds for the chemical and associated trades. Thus a prosperous and extensive business has been built up over the past 125 years, and the company looks forward with satisfaction to the future.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

"The Revolution Nobody Noticed"

TO THE EDITOR OF METAL INDUSTRY

SIR,—Many who, like myself, are professionally concerned with the use of steel in the working of non-ferrous metals, will, I am sure, share my distress that the British Iron and Steel Federation should have sponsored an advertisement—"The Revolution nobody noticed"—now appearing in the national press.

This depicts photographically and by way of a line drawing a modern kitchen; in the line drawing are twenty-six articles made "wholly or partly from steel". The statement is doubtless true: nevertheless, the "partly" covers applications so untypical and uses so exiguous that in total the picture presented is gravely misleading and unquestionably damaging (having regard to the limited knowledge of the public in matters of manufacturing materials and methods) to designers, producers and sellers of switchgear, kitchen mixers, children's toys, faucets —to choose only the most grossly misrepresented items from the list. In all these, non-ferrous metals are the *typical* major materials. To suggest that the head of a kitchen mixer die-cast in aluminium is, in fact, made of steel, as this advertisement does, can only be confusing to the public and of no great service to the steel industry. The merits of stainless steel in the kitchen are obvious, and those of enamelled plate, in appropriate applications, may be conceded, but non-ferrous kitchen goods, and especially die-castings, are associated with altogether wider possibilities of product design, and it is unfortunate that the enthusiast responsible for this advertisement has sought to link his industry's products with the undoubtedly attractive design features that are virtually specific to non-ferrous metals processed by the newer precision metalworking techniques. It is to be hoped that the advertisement in question will be withdrawn without delay.

Yours, etc.,

H. K. Barton.

Roughfield,
Etchingham,
Sussex.

Die-Casting Review

Design of Die-Castings

By H. K. BARTON

XI—Conversion from Bar Stock

MANY small die-cast components in zinc alloys, and a few in aluminium alloys, replace pieces previously produced by repetition machining. Although the original material is usually a free-machining brass, it is very rare for a copper-base die-casting to be called for in such conversions: for most applications the physical properties and mechanical characteristics of the zinc alloys are perfectly adequate to the functioning of the component. Where the conversion is from a piece originally machined from steel rod, both light-metal and zinc alloy die-castings have the advantage of not requiring a protective coating to prevent rusting in normal exposures.

Repetition machining starts out with a considerable advantage when the production of small precision components is under consideration, for the cost of tooling-up—the provision of cams, collets and cutting tools—is very small compared with the cost of die-casting dies and trimming tools. Moreover, it may well be the case that, even then, secondary operations such as drilling and tapping must be performed on the die-cast part; these can seldom be performed so expeditiously and economically upon the separate die-castings as they can upon rod stock prior to parting-off.

Despite these disabilities, it quite often occurs that periodic investigations into component costs show that, by reason of increased demand, it would be advantageous to convert to die-castings certain components previously produced most economically as screw-machine products, whereas the reverse change, from die-castings to bar stock, hardly ever occurs and—in the writer's experience—never on purely economic grounds.

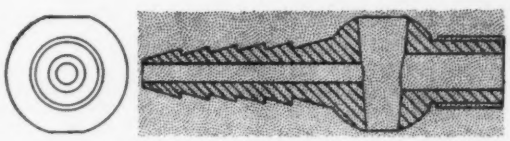
The prime reason for most conversions, in this particular field, is the high rate of material wastage associated with so many parts machined from rod or bar. Some typical sections of repetition-machined parts are depicted in Fig. 1; the wastage, indicated by the stippled areas, may easily exceed 75 per cent of the weight of stock used. Certainly, brass swarf can be reclaimed readily enough, so that the net loss is less than at first appears, but it is still a major factor in part cost. For a total production of a few thousand—or sometimes a few hundred thousand—the high initial tooling cost of die-casting outweighs this and other continuing wastages associated with the machined part, but ultimately, for almost all such products, there comes a point where the falling curve of the die-casting piece-price intersects the almost constant level of the repetition-machined component, as indicated in the graph of Fig. 2.

Although there is a superficial diversity of form among components machined from bar stock, in point of fact they are for the most part composed of a relatively few constantly recurring elements — internal and external grooves, flanges, bores parallel or transverse to the axis of the stock, milled slots, screw-threads and so on. It is the orientation of such elements, rather than the overall shape and size of the part, which determines whether any modifications are desirable to make the conversion to die-casting fully satisfactory.

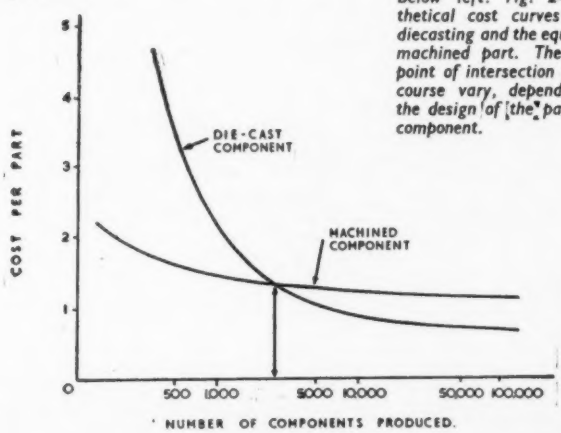
The first point that the designer has to consider is that, whereas the repetition-machined part has only one possible orientation with respect to the stock—the axis of the part and that of the rod must necessarily be coincident—in most cases there is a choice of orientations for the die-cast equivalent. This is so, for instance, with two of the three components, *a* and *b*, of which the sections appear in Fig. 1; each can be die-cast with its axis either normal or parallel to the die parting. If the latter be chosen, a diameter of the component must lie in the plane of the die parting, as indicated in Fig. 3, but if the component axis is normal to the parting plane there is often a choice of positions for the joint-line on the component which indicates the position of the die parting.

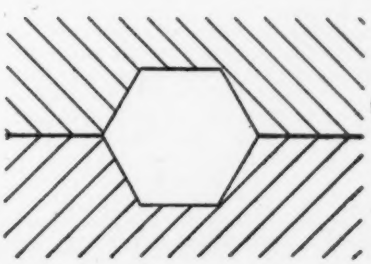
This is of importance, for often the right choice of the joint line determines whether the component can be easily and cleanly trimmed of flash. In the component of Fig. 4, for example, the die parting may lie anywhere between positions *A* and *B*, since the hexagonal perimeter is identical for all sections between these points. Nevertheless, it is clearly advantageous when, as here, there is no predetermined position for the joint, to locate it at either *A* or *B* so that the whole of the hexagonal portion is formed within one die member. Die construction is

Right: Fig. 1—Typical repetition-machined parts; the stippled areas indicate the quantity of stock required for each

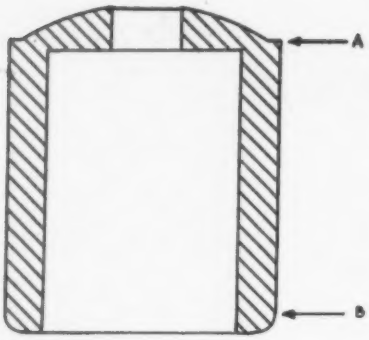


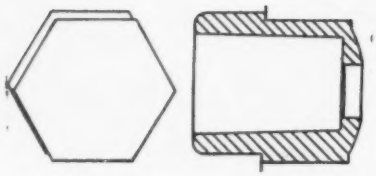
Below left: Fig. 2—Hypothetical cost curves for a diecasting and the equivalent machined part. The actual point of intersection will, of course vary, depending on the design of the particular component.





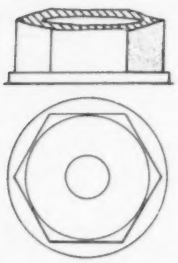
Right: Fig. 3—Since most repetition-machined components are symmetrical, the axis of the replacement die-casting must lie in the plane of the die parting

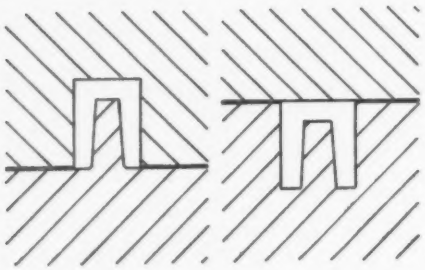




Left: Fig. 4—The cross section being constant from A to B, the parting plane can lie anywhere between them

Above: Fig. 5—The effect of an intermediate parting position





Left: Fig. 6—Cavities and cores are almost always disposed as on the left

Above right: Fig. 7—The provision of a narrow circular flange facilitates production and often improves the functioning of the part

thus simplified (for hexagonal cavities have to be hobbed in separate cavity inserts) and the component is rendered easier to trim.

If, for example, the component was cast with the joint halfway between *A* and *B*, it would be extremely difficult to maintain the two parts of the cavity in perfect alignment and angular registration; any wear on the register pins would result in the effect shown, with much exaggeration, in Fig. 5. It is impossible to shear the flash from such a casting without taking a broaching cut right down the faces of the displaced half of the hexagon, resulting in a particularly unsightly effect.

The choice is therefore between *A* and *B*, and here the designer may follow the general rule that, wherever possible, the core should be in one die member and the cavity in the other. The reasons why this is desirable are almost too many to enumerate; the first and most cogent is that the force required to eject the component from the die is much greater in the tool at the right of Fig. 6 than in that on the left. A less expensive tool, with a simpler ejector system and a faster rate of operation, is thus possible in the case of the latter disposition. Additionally, however, there are advantages in the left-hand layout when it comes to trimming the components, for as a rule it is easiest to locate the casting in the trimming die so that it is supported on the projecting flash, and to locate the punch within the cored recess as it comes down. The casting thus helps to centre the punch in the die opening, an effect not easy to achieve if the joint is at *B* (Fig. 4) and the small end of the cored recess is accordingly presented to the punch. These considerations apply equally when an inverted trimming tool is used, the castings then being dropped over the upward-pointing punches and the die brought down over them.

On virtually every count, therefore, it is preferable to locate the die-parting at the open end of the component, but with this decided there is still another factor, connected with ease of trimming, which ought always to be considered. This is the possibility of simplifying the shape of the trimming perimeter. In the present example, where the cavity is of hexagonal form, it is possible by merely adding a small flange to achieve a circular trimming perimeter, as in Fig. 7. This is often a functional advantage, since the hexagon is intended to take a spanner and the flange prevents the spanner from slipping and bruising adjacent parts. It is, however, quite impracticable to provide such a flange on a repetition-machined component, since this would entail using round stock and machining the hexagon.

The provision of the flange makes trimming easier and faster, as well as cheapening the trimming die. Most components of the sort here considered are produced from dies containing up to twenty identical cavities, so that the spray of castings is gang-trimmed in a twenty-hole shaving die. It is very difficult to avoid minor displacements of one or two such castings during handling between casting and trimming: if one or two castings on a spray are even a few thousandths of an inch out of position it is difficult to locate them so that the die picks them up correctly when the casting and the die opening are of identical form and size. There is much more latitude if a plain circular die, slightly larger than the hexagon, can be used in the trimming tool.

TABLE I—AS-CAST SIZES FOR CORED HOLES, NOT FOR TAPPING

Alloy Group	Depth and Draft	Nominal Hole Diameter (in.)					
		$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Zinc	M.E.D.	$\frac{3}{8}$	1	$1\frac{1}{2}$	2	$3\frac{1}{2}$	$4\frac{1}{2}$
	Draft in/in.	0·048	0·030	0·026	0·024	0·018	0·014
Aluminium	M.E.D.	$\frac{5}{16}$	1	$1\frac{1}{2}$	2	$3\frac{1}{2}$	$4\frac{1}{2}$
	Draft in/in.	0·075	0·052	0·042	0·035	0·030	0·023
Magnesium	M.E.D.	$\frac{5}{16}$	1	$1\frac{1}{2}$	2	$3\frac{1}{2}$	$4\frac{1}{2}$
	Draft in/in.	0·073	0·044	0·034	0·027	0·025	0·023

M.E.D.=Maximum Economic Depth: Deeper holes can be cast but add disproportionately to the production cost.

TABLE II—AS-CAST SIZES FOR CORED TAPPING HOLES
(B.S.P., $\frac{1}{8}$ in.-$\frac{3}{4}$ in.)

Nominal Size (in.)	Threads per inch	Effective Diameter (in.)	Core Diameter		Lead-in Depth (in.)
			Top (in.)	Bottom (in.)	
$\frac{1}{8}$	28	0·360	0·352	0·348	0·032
$\frac{1}{4}$	19	0·484	0·473	0·468	0·050
$\frac{3}{8}$	19	0·622	0·611	0·606	0·050
$\frac{1}{2}$	14	0·779	0·764	0·757	0·075
$\frac{5}{8}$	14	0·856	0·841	0·834	0·075
$\frac{3}{4}$	14	0·995	0·980	0·973	0·075

With the external form thus determined, the cored recess in the die-casting may next be considered. Here the choice is between casting the thread, which entails unscrewing the core from the component, and coring a plain hole for subsequent tapping. It may be said at the outset that the former alternative is today seldom economic, and in all but a tiny minority of applications it is better to machine internal threads rather than die-cast them. This is not because a cast thread is in any way unsatisfactory—in point of fact, uniformity of thread profile can be better maintained in blind holes with a die-cast thread than with a machined one—but because of the high tool cost and low production rate inseparable from die layouts involving unscrewing cores.

In the repetition-machined component, the steps preparatory to tapping are to drill to tapping size and, if the mating threaded part is to bottom in the hole, to provide an annular relief as in Fig. 1a. The die-cast component comes from the die with a slightly tapered bore, and if a full thread to full depth is essential, it is necessary to ream and relieve the bore prior to tapping. Rarely, however, does it appear when a full investigation is made that these steps are absolutely necessary; often they are merely thought to be so because they have always been performed on the bar stock.

Assuming that the minimum length of thread engagement is determined by the likelihood of shear, it is commonly found that assemblies embodying threaded collars or caps of the sort under discussion have a safety factor of anything from three to five hundred per cent; this probably indicates that the criteria determining the proportions of such small parts are primarily aesthetic—the designer chooses a length : diameter ratio which "looks right". As that may well be the touchstone by which the user judges the assembled product, this intuitive approach is not necessarily a wrong one; however, it does allow a considerable latitude to the designer when converting to die-castings.

Thus, for example, instead of threading both the cap and the mating element full length, for the vast majority of applications it suffices to let the thread run out near the bottom of the bore in the cap, and to finish the male thread well short of the end of the spigot. There is then no interference due to the incomplete form of the internal thread, whilst the mating part can still bottom in the cap, or against a terminal washer, as before. Such an assembly avoids the need for reaming the bore before tapping, since the as-cast taper can usually be brought to a value which will yield a satisfactory thread depth over the whole length of engagement.

It is important to remember that, as a rule, optimum tapers on cored holes differ according to whether the holes are subsequently to be tapped, or not. Those recommended for holes not to be tapped—clearance holes for screws and bolts, mating holes for integral rivets and the like—are given in Table I. This is adapted from Standard Number Six of "Engineering Standards for Pressure Die Castings"[1]. These tapers do not, however, yield satisfactory threads unless the cored holes are reamed. For most purposes a thread which is about two-thirds full-depth at the top, and three-quarters near the bottom, is fully adequate: this allows for a degree of taper which, provided that the cores are draw-polished to a good finish, allows reasonably easy ejection. In the case of multi-diameter cores forming stepped holes of which only one diameter is to be threaded, the non-threaded portions should be given the more generous draft allowances.

Tapers for holes to be threaded, based upon the fractions of full depth suggested above, are, of course, variable according to the length of thread in any particular instance; the proportions can be considered acceptable for any thread-length up to twice the nominal diameter and tolerable, exceptionally, for thread-lengths of two and a quarter times the diameter. However, there can be few die-castings in which a screw thread more than the former length is functionally necessary. Table II gives the as-cast sizes for tapping holes at top and bottom; these are subject to normal allowances for cooling contraction, varying with the alloy group, but this is a matter to be taken care of by the die-caster.

It is an advantage to provide a lead-in, a few thousandths of an inch larger than the tap diameter, at the entrance to holes that are to be cored. This has a countersink where it joins the tapered bore, as indicated in Fig. 8. The depth p of the lead-in may be standardized at about unit pitch—i.e., at 0·050 in. for a 20 t.p.i. tapped hole—and rounded off values are given in Table II for B.S.P. screw-threads.

Cast internal threads are full form so far as each individual profile is concerned, but an absolutely parallel thread is not achievable. It is impossible to lay down any hard and fast rules for the tapers on die-cast threads, and these must be determined in consultation with the die-caster who will have the responsibility of holding the limits. As has already been noted, there are very few instances where it is not better to machine the thread than to cast it. Probably the only occasions where a die-cast internal thread is really advantageous is in very shallow caps, such as that in Fig. 9. Here the depth of the internal recess is equal to only about three full turns of the required thread; taking away the lead-in and necessary relief would leave a machined cap with little more than one full thread. By die-casting the thread, however, it can be carried full form right up to the inside face of the component, providing maximum engagement for the available length.

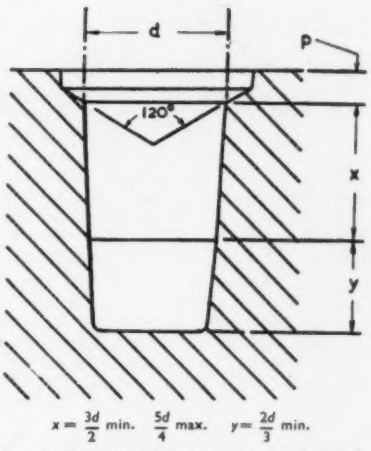


Fig. 8—Recommended proportions of cored tapping holes

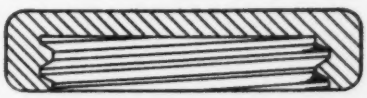


Fig. 9—A cast-to-form left-hand thread in a shallow diecast cap

Reference

[1] "Engineering Standards for Pressure Die Castings." Zinc Alloy Die Casters Association, 34 Berkeley Square, London, W.1.

(To be concluded)

Industrial Air Heating

A RANGE of industrial air heaters, manufactured initially in three sizes, rated at 250,000, 350,000 and 500,000 B.Th.U.s, has been introduced by Colt Ventilation Limited, Surbiton, Surrey.

Theoretically, a minimum of 14 lb. of air is required for the complete combustion of 1 lb. of gas oil. In the conventional oil-fired air heater the mixture is 20 to 50 lb. of air to 1 lb. of gas oil. In the Colt Combustion Unit the mixture is 16 lb. of air to 1 lb. of gas oil.

In this heater two contra-rotating air streams are created, fulfilling three distinct functions. First, the interaction between them creates air turbulence, which ensures the complete and rapid mixing of the oil mist and the air. As a result, excess air requirements are reduced to a minimum. Secondly, the vortices "hold" the flame, so that complete combustion is achieved in a limited space less than 15 in. long. Thirdly, the outer air stream forms a barrier layer which prevents the flame impinging on the chamber walls.

This means that the size of the combustion chamber can be much smaller than in conventional heaters.

INSTALLATION FOR SPECIAL ALLOYS AT HENRY WIGGIN AND COMPANY LIMITED

Vacuum Treatment of Molten Metals

RECENTLY installed at the Birmingham works of Henry Wiggin and Company Limited for the vacuum refining of special alloys, a de-gassing and vacuum refining unit gives close control over temperature and pressure. Basically it is a 15 cwt. mains frequency induction melting furnace housed in a tiltable vacuum tank. The equipment has been designed and built by Birlec-Efco (Melting) Limited, Tyburn Road, Birmingham.

A water-cooled copper induction coil, which is supported by a magnetically shielded steel framework, forms the furnace proper. Special insulating techniques and careful design work have eliminated the difficulties of handling high voltages in vacuum, ensuring that no troubles arise through electrical breakdowns within the furnace.

The choice of mains frequency was based not only on the lower cost of the mains frequency electrical gear when compared with H.F. equipment but also on the inherently greater degree of turbulence which a mains frequency furnace imparts to the molten metal. This turbulence stirs the bath thoroughly and brings new metal to the surface where gases and volatile metals can be drawn off.

The present installation has a rating of 300 kW and is arranged for connection to a low tension three-phase supply. 300 kW gives this unit ample power for melting duty, though, for refining service only, a maximum rating of 200 kW would suffice.

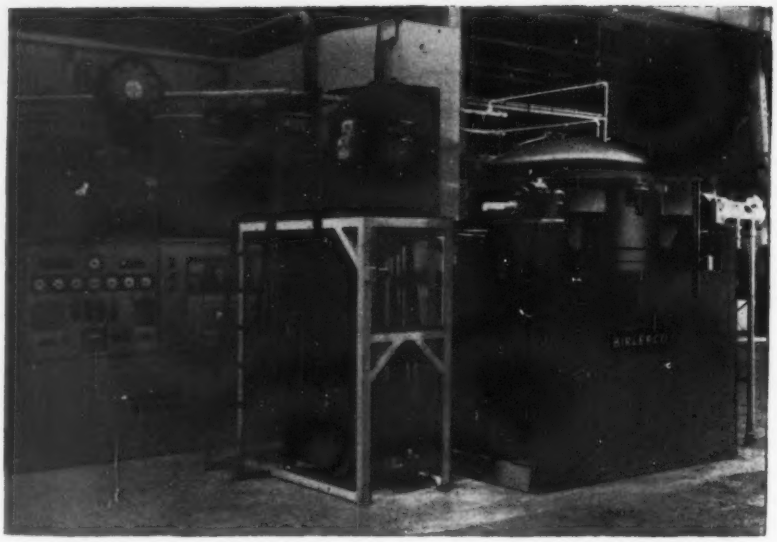
The vacuum tank, which houses the furnace, is mounted on trunnions and tilted by twin hydraulic cylinders. The tank movement produces an approximately lip-axis pouring effect from the furnace, and a retractable bridge over the top flange of the tank carries the metal stream.

Hydraulic controls open and close the vacuum tank lid and pneumatic clamps lock the lid on to the tank.

The furnace mouth carries a refractory cover and this cover has holes which correspond with a viewing port in the chamber lid. This refractory cover reduces heat losses and cuts down the loss of metal by splashing.

The vacuum pumping lines are connected to the tank concentrically with the tilting trunnion and in this way pumping connections are not demounted when the furnace tilts. The present installation includes a three stage pump set which gives ample gas handling capacity over the whole range. Automatic controls maintain the correct pumping sequence and a dust trap protects the pump set from damage by fumes and metal splashes.

Pirani and dial gauges monitor the furnace pressures. The whole equipment was designed for use by relatively unskilled personnel with a minimum of technical supervision.



Furnace Operation

A typical vacuum refining cycle occupies about one hour. Liquid metal is brought to the furnace by ladle and, when the furnace is charged, the hydraulic gear lowers the lid into position over the chamber and pneumatic clamps lock it in place. The chamber pressure is then reduced to about 200-300 microns in about 15 min.

During refining, sufficient power is applied to the furnace to ensure thorough stirring of the molten metal and to maintain temperature at the desired value.

After vacuum treatment, air is admitted back into the furnace, the hydraulic gear raises the lid and the retractable spout is placed in position. The temperature of the metal is adjusted and checked by dip thermocouple and various other checks are made, after which the furnace tilts, pouring the vacuum refined metal into a ladle for casting or teeming in the conventional way.

The application of vacuum to the melt removes gases and volatile metals. The results obtained so far have proved extremely satisfying and the high temperature properties obtained on vacuum-refined metals have exceeded those forecast, basing the estimates on work done in the laboratory. A standard basic refractory lining is in use and gives satisfactory life. It is rammed around a normal type former and presents no special problems.

The properties obtained on vacuum-refined metal are particularly gratifying since they come from a furnace which produces the desired effects at a fraction of the cost of an equivalent conventional vacuum melter. With a reasonable degree of utilization actual costs are only a few pence per pound of metal treated.

The mains frequency de-gassing and vacuum-refining furnace can bring practically all the benefits of vacuum melting into the foundry and melting shop at an extremely low capital and operating cost. It provides a tool which gives close control over gas content, chemical composition and metal temperature.

Sintered Brass

AN improved sintering technique for brass powders was outlined in a Paper presented by F. I. Zaleski and R. A. Powell before the 15th Annual Meeting of the Metal Powder Institute. The technique uses lithium stearate rather than the conventional zinc stearate as the lubricant during moulding, and sintering takes place in a nitrogen atmosphere.

It is claimed that this new development increases tensile strength from 29,000 lb/in^2 to 40,000 lb/in^2, and elongation from 11 per cent to 29 per cent for brass powder parts. Lower operating costs are also claimed because of less critical atmospheres and sintering temperatures, and less expensive gas.

Preliminary studies show that improved properties can also be obtained with lithium stearate in compacts of copper and iron.

Industrial News *Home and Overseas*

N.P.L. Order New Furnace

News from **The General Electric Company Ltd.** is that, in association with Vacuum Industrial Applications Ltd., they have received an order from the National Physical Laboratory for a 2-litre vacuum arc melting furnace. The furnace will be used for melting and casting refractory metals such as titanium, niobium, molybdenum, etc.

The furnace may be used for melting by either the consumable or non-consumable electrode process. In the former case the ingot is formed from an electrode of the parent metal which is fed progressively into a molten pool in the mould; non-consumable electrode melting is effected by using a tungsten electrode to strike the arc into which the charge is fed as small particles.

Power is being supplied by a 2,000 amp, 40 volt germanium rectifier unit. The rectifier output is controlled by means of a saturable reactor connected in the primary side of the rectifier transformer, enabling the output current to be varied from 500 amp up to 2,000 amp. The power unit has a short time overload capacity of 2,500 amps.

A two-stage pumping system is provided, comprising an oil booster-diffusion pump backed by a rotary pump. The working chamber pressure is 0·1 microns Hg, and the pumping speed is sufficient to maintain this pressure against gas evolution from the electrode and molten pool.

Ammonia Crackers

For some years the use of 75 per cent hydrogen-25 per cent nitrogen mixtures (derived from cracked ammonia) has grown steadily, and more recently the high temperature cracker has increased in popularity. Using a specially developed catalyst with exceptionally long life and high activity, high temperature ammonia crackers are now being produced by the Gas Atmospheres Division of the **Incandescent Heat Company Ltd.**, to the design of the Drever Co., Bethayres, U.S.A.

These plants have outputs from 150 to 5,000 s.c.f.h., and are produced in ten standard sizes. Copies of articles giving results of comparative tests between pure hydrogen and hydrogen-nitrogen mixtures in the hydrogenation of triglycerides, lard, nitriles and fatty acids, together with information on metallurgical and other uses of cracked ammonia, may be obtained on application to the company.

New Sales Office

A new area sales office has been established in Cardiff by **Birlec Limited,** and Mr. W. H. Statham has been appointed area representative for South Wales. His headquarters will be at Associated Electrical Industries Ltd., Mervyn House, Frederick Street, Cardiff, with the telephone number of Cardiff 28511. Mr. Statham joined Birlec in 1946 and, prior to his new appointment, was a sales engineer in the Furnace Division of the company.

Hydraulic Equipment Makers

We understand that an **Association of Hydraulic Equipment Manufacturers** has been formed, with offices in London. The object of this new organization is to look after the interests of the industry in this country as a whole, encourage and sponsor research for the benefit of its members, and advise on exhibitions at home and abroad.

Gas Cleaning Plant

It is learned from **Head Wrightson Iron and Steel Works Engineering Ltd.** that they have received an order from Colvilles Ltd. for the supply and construction of a blast furnace gas cleaning plant at Ravenscraig, in Scotland. This is an extension to a similar plant constructed by Head Wrightson two years ago at Ravenscraig, and forms part of the extensive strip mill project which Colvilles are at present undertaking.

The complete plant will be capable of cleaning 15,000,000 ft^3/hr. of blast furnace gas, and the new equipment now to be supplied will comprise one gas washing tower and two Head Wrightson research Cottrell wet tube electrostatic precipitators, together with the necessary gas mains, valves, pumps, etc. Ancillary equipment will also be supplied for the handling and recovery of sludge from the circulating water system. The value of this contract is said to be approximately £357,000.

Contract from Holland

A contract for a gas reform plant to treat natural gas for the production of ammonia synthesis gas has been awarded to **Chemical Construction (G.B.) Ltd.** by N.V. Maatschappij Tot Exploitatie Van Kooksovengassen, of Ijmuiden, Holland. The plant will reform approximately 125,000 M^3/day of natural gas, and is followed by a CO conversion plant producing a gas suitable for sending to the existing purification and ammonia synthesis plant.

Israeli Copper

Shipments of copper-cement during the first year of operation of the copper plant at Timna, 15 miles north of Israel's Red Sea port of Elath, totalled 3,200 tons. They went to various European and Asian countries. During its first year, the plant has completed its running-in period and has also had an enforced shutdown lasting several months. It is only in recent months that the plant has started producing at full capacity and next year's output is expected to reach 7,000 tons.

Israel's Minister of Development said that in recent months Israel's copper cement had obtained a price of 640 dollars per ton. Next year's production would be sold to Japan, Brazil, Hungary, West-Germany, Britain and Portugal. An additional investment of 3·4,000,000 dollars would enable the company to raise production by 10 to 20 per cent.

Molybdenum in Sardinia

A molybdenum deposit, claimed to be second in world importance to that at Climas, Colorado, U.S.A., has recently been discovered by the firm of Mazzacurati and Giacomelli, of Rome. A spokesman for the firm said the deposit was in the locality between the two towns of Ala dei Sardi and Buddoso, in Sardinia. Its area extended over 7,000,000 square metres, and, according to a provisional estimate, the deposit amounted to about five million tons of molybdenum. The percentage of molybdenum in the rock was 0·6, which experts rated high. First estimates gave the cost of extracted molybdenum at around 1·25 dollars per lb.

The firm of Mazzacurati and Giacomelli, which has a permit to explore for molybdenum, iron, copper, wolfram and pyrite ores, has applied to the Sardinian Region for a grant to build two dams on the Pannunzu River, to contain the waters necessary to feed a pilot plant, and an industrial plant for the enrichment of the crude ore.

Soviet Production

Speaking at the third session of the Supreme Soviet last week, Mr. Alexei Kosygin said that the State plan for development of the Soviet Union national economy for 1960 provided for a further increase in the output of non-ferrous metals and precious metals.

New Nickel Mine

It is reported from Helsinki that the Finnish Government copper mining corporation, Outokumpu Oy, will start exploitation of its new nickel mine at Kotalahati at the beginning of 1960. Ore output in the first year will amount to some 300,000 tons. The ore will be enriched on the spot and taken to the nickel smelter at Harjavalta. The sinking of the mine which, it is thought, will meet Finland's nickel requirements, started in 1957. The deposit is expected to last for ten years.

Northern Rhodesia Minerals

Provisional figures issued by the Mines Department of the Ministry of Labour and Mines show that the value of mineral production in Northern Rhodesia for the first eight months of this year have already exceeded the total for the whole of 1958. Values for the first eight months of 1959 now aggregate £85,116,040, compared with £55,267,582 for the corresponding period last year, and with £77,262,866 for the entire term of 1958.

At 33,152 tons (valued at £6,975,367), Northern Rhodesia's August production of electrolytic copper was exceeded on only one other occasion this year. Production of blister copper, 11,796 tons (£2,311,802) was the lowest. Zinc tonnages of 2,600 were also the best recorded in 1959, and the provisional yield of £221,772 the highest for the year.

Better prices were realized for lead, of which the output was steady at 1,200 tons, but there were declines in outputs and returns from manganese ore, one description of cobalt and gold.

Silicon Rectifier Equipment

What is believed to be the largest silicon rectifier equipment made in this country to date has just been completed by **Westinghouse Brake and Signal Company Ltd.**, and is being shipped to India to provide current for electrolytic cells producing chlorine and caustics.

Silicon rectifiers have been chosen on account of the high temperature; germanium offers a slightly superior efficiency below 100 volts D.C. or so where the climatic conditions allow of its

use. Westinghouse are building several large germanium rectifiers, such as 18,000 amps at 95 V for Tasmania and 14,000 amps at 70 V for Holland, where cool conditions prevail, while for hotter climates Westinghouse choose silicon for such contracts as 12,000 amps. at 110 V for Israel, 9,000 amps at 80 V for Turkey, and for other plants in Pakistan employed for hydrogen production.

Tin Buffer Stock

A usually reliable Government source said in Kuala Lumpur last week that Malaya would ask for the present International Tin Buffer Stock to be liquidated when the International Tin Agreement expired in June 1961. It is understood that Malaya would press for a new Buffer Stock to be set up under the new agreement now being drafted. This decision followed a proposal by Malayan tin miners to this effect.

If tin prices remained at a reasonable level, liquidation of the present Buffer Stock should mean that Malaya's tin miners would be able to get back money they had contributed to the Stock during its five years of existence. This would help them to pay off debts and loans advanced to them by the Malayan Government to meet their contributions.

The source said that the principle Malaya was trying to have included in the draft of the new agreement was that the Buffer Stock under the current agreement should be liquidated entirely, and a new Buffer Stock established under the new agreement.

The draft of the new agreement is to be considered by the International Tin Council in December. The draft is then to be presented to a United Nations conference in New York in May.

London Symposium

Readers are reminded of the Symposium organized by the **Institute of Metals,** to be held in the Lecture Theatre of the Royal Institution, Albemarle Street, London, W.1, on "The Application of Thin-Film Techniques to the Electron-Microscopic Examination of Metals".

This event will be held on Thursday, November 12, commencing at 9.30 a.m., and after lunch at 2.15 p.m. At the morning session, with Dr. N. P. Allen, M.Met., F.R.S., presiding, a number of Papers will be briefly presented and then discussed.

At the afternoon session, Professor Sir Lawrence Bragg, O.B.E., M.C., D.Sc., Ph.D., LL.D., F.R.S., will preside, and further Papers will be presented and discussed.

At the conclusion of the discussion at the afternoon session, three films will be exhibited dealing, respectively, with dislocations, precipitation, and the annealing of radiation damage.

On the evening prior to the Symposium there will be an informal Conversazione at 17 Belgrave Square, S.W.1, at 7.30 p.m., for which tickets (price 6s. to cover light refreshments) may be obtained from the secretary to the Institute. There will be an exhibition of electron-micrographs, models, etc., and at 8.30 p.m. there will be a showing of four films.

Metal Finishing Symposium

Readers are also reminded that the Institute of Metal Finishing, London branch, has arranged a Symposium on **Progress in Polishing,** which is to be held on Wednesday, November 18, 1959, in the Recital Room of the Royal Festival Hall, London, S.E.1.

Proceedings will commence at 9.30 a.m. During the morning session two Papers will be presented, the first on "Automatic Polishing", by J. H. Bryan and J. P. Dewar, and the second on "Liquid Polishing Compounds" by J. Scouse. Following luncheon, the afternoon session will commence at 2 p.m., when two further Papers will be given, the first "Electrolytic and Chemical Polishing", by F. H. Wells, and the second "Barrel Polishing", by C. J. Kellard.

Admission is by ticket only, price 32s. 6d., and applications for tickets should be made to S. W. Baier, 9E Cleveland Road, London, W.13. This sum covers copies of Papers, morning coffee, buffet luncheon, and tea and biscuits.

A Northern Depot

News from **Expandite Limited** is that they have opened a Northern factory and depot at Trafford Park Road, Trafford Park, Manchester, 17. This new depot will be managed by Mr. Roland Bell, who is also the North-Western area manager for the company.

Order from Australia

An order to a value in excess of £120,000 sterling, for the supply and installation of electronic recording and control equipment for the Cockle Creek works of Sulphide Corporation Ltd., in New South Wales, has been secured by **Elliott Brothers (London) Ltd.** and **Siemens Edison Swan (Australia) Pty. Limited.**

The equipment to be supplied includes a completely integrated weight control and blending system regulating the feed of materials to an I.V. smelting furnace. Completion of the order is called for by July, 1960.

Atomic Energy Exhibition

Opening to-day in Sheffield for nine days is an exhibition on Britain's nuclear power programme and the uses of radio-isotopes in industry, medicine and research, presented by the U.K. Atomic Energy Authority. A special feature of the exhibition is a working model built by the Authority to demonstrate the operation of a nuclear reactor. It consists of a large "cut-away" model of Calder Hall and its associated turbines, equipped with a panel from which the reactor controls can be operated.

The exhibition will visit other cities in the near future, including Bristol and Bradford.

A Change of Name

In order to clarify its association with the parent company, The Morgan Crucible Company Limited, the name of Synthetic Carbon and Engineering Company Ltd. has been changed to **Morgan Components Limited.** This company's capacity at the Stanmore premises has been enlarged, and will be concentrated on the sales and production of all brush holders hitherto manufactured by the two companies.

Morgan Components Limited will continue to manufacture and supply a variety of metal contacts and associated metal assemblies which were formerly supplied by the company under its old name. Enquiries and orders for carbon brushes and carbon contacts should now be sent to The Morgan Crucible Company Limited at Battersea, London, S.W.11, and the interests of the two companies will now be covered by a single force of sales representatives.

Stepless Control

An Electr-O-Volt control unit, providing continuous contactorless regulation of electric power, has been made available by **Honeywell Controls Ltd.** This unit, which operates with continuous balance measuring instruments, provides an economical and accurate form of temperature control for all types of electrically-heated furnace.

By a proportional adjustment of power input when load changes occur, the Electr-O-Volt unit stabilizes furnace temperature continuously. Because the control action is non-cyclic, temperature changes in the heating elements occur gradually, and over a smaller range than when on/off systems are used.

The Hydra-Spray

Following the recent announcement that **Alfred Bullows and Sons Ltd.** are now sole U.K. distributors of the Graco range of equipment, details are given of one of the most important items of this American equipment. This is the truck-mounted Hydra-Spray, which operates by use of high hydrostatic pressures, varying from 1,000 to 3,000 lb/in^2. These high pressures are achieved by the use of a reciprocating double-acting air motor, coupled by a connecting rod to a reciprocating double-acting pump which multiplies the fluid pressure to twenty times the air pressure admitted to the air motor, e.g. with an incoming air line pressure of 80 lb/in^2 the pump develops 1,600 lb/in^2 fluid pressure.

This extremely high pressure is confined to the pump, to the 20 ft. length of Teflon tube and to the spray gun. The Teflon tube is reinforced with an external stainless steel wire braid and has a burst pressure of 10,000 lb/in^2. The spray gun is fitted with a tungsten carbide nozzle to resist the erosion of abrasive paint when under high pressure. There is not, at any time, any pressure in the paint container.

The maximum permissible length of fluid hose to each gun is 80 ft., this length being obtained by coupling four standard 20 ft. lengths, and although, as standard, one spray gun is supplied with each unit, two guns can be used simultaneously with unimpaired performance. A dual outlet manifold is fitted to each unit for this purpose at no extra cost.

Heating Symposium

On Thursday of last week, at the Dorchester Hotel, London, a successful Symposium on the subject of heating was held by the **Copper Development Association.** Some 230 invited members of the many professions, trades and industries engaged in the design, manufacture and installation of all types of heating systems were present.

Under the chairmanship of Dr. Maurice Cook, C.B.E., chairman of the Metals Division, Imperial Chemical Industries Limited, four Papers were presented. These Papers, "Heating Problems from the Architect's Point of View", by K. Allerton, A.R.I.B.A., County Architect's Department, Nottingham; "Panel Heating", by D. Rudd, B.Sc., M.I.E.E., M.I.Mech.E., M.I.H.V.E.; "Electrical Floor Warming", by E. M. Ackery, A.F.C., B.Sc., M.I.H.V.E., of the British Electrical Development Association; and "Small-Bore Heating", by E. Carr, Ph.D., B.Sc.,

C.G.I.A., of the Copper Development Association, after summing up by W. H. Allen, A.R.I.B.A., of the Building Research Station, provided comprehensive material for the final discussion.

The advantages and applicability of each of the three types of systems were the subject of considerable debate. Typical points raised included: the necessity for providing economical means of increasing the normal comfort level of warmth to meet increased temperature demands under varying conditions at different periods; closer liaison between the smaller architect and heating engineer; and suggestions that electrical heating should no longer be considered as a separate branch of heating engineering.

Representatives from France, Sweden and Switzerland spoke on some of the various aspects of heating in each of their countries. During the luncheon recess those present were able to inspect a display of small-bore, panel and electrical floor warming heating systems using copper tube or copper mineral insulated cable. Included in the display was an example of a solar heating unit embodying copper-tube-in-strip.

A Birmingham Meeting

A joint meeting of the **Birmingham Metallurgical Society** and the local section of the Institute of Metals will be held on Thursday next, November 12, at 6.30 p.m., at the Birmingham College of Technology, when a Paper will be presented by Mr. J. B. Cotton, A.M.C.T., A.R.I.C., on "Recent Corrosion Studies on Titanium".

The lecture will include reference to the Anodic Polarization characteristics and the formation of protective film. This will be illustrated by cine film.

U.K. Metal Stocks

Stocks of refined tin at the London Metal Exchange official warehouses at the end of last week fell 179 to 7,671 tons, comprising London 4,504, Liverpool 3,007 and Hull 160 tons.

Copper stocks fell 1,593 to 7,857 tons, distributed as follows: London 1,673, Liverpool 4,084, Birmingham 75, Manchester 1,925, and Hull 100 tons.

Change of Address

News from **Kelvin and Hughes (Industrial) Ltd.** is that Mr. H. Benton, their representative for the North Wales, Cheshire and Lancashire area, has now moved to a new address at 27 Laneside Drive, Bramhall, Cheshire, with the telephone number of Bramhall 2841.

80 Ton Arc Furnace

In connection with a scheme for casting vacuum ingots for forging, English Steel Corporation Ltd. has ordered from **Birlec-Efco (Melting) Ltd.** a 21 ft. diameter arc melting furnace.

This new furnace, with a nominal charge capacity of 80 tons, is stated by the makers to be the largest in this country. To be rated at 20,000 kVA, the furnace will be supplied with an A.E.I. transformer equipped with "on-load" tap changing equipment of the resistor bridging type, arranged for remote electrical control.

Canadian Metals

It is reported from Ottawa that production of copper in August rose to 35,045 tons, from 30,617 a year earlier, nickel to 16,784 tons from 12,517, and lead to 14,104 tons from 12,460, while output of silver declined to 2,518,288 fine ounces from 2,889,154, and zinc to 33,694 tons from 35,450.

January-August totals (with revised figures for the same 1958 period in parentheses) were: copper 257,955 tons (256,454 a year ago); nickel, 117,282 tons (118,389); silver 21,395,484 fine ounces (20,343,418); lead, 127,663 tons (121,128); and zinc, 266,700 tons (284,781).

Forthcoming Meetings

November 9 — Institution of Production Engineers. East and West Ridings Region. Sheffield Branch. Grand Hotel, Sheffield. "Pre-Stressed Rolling Mill." W. Udall. 6.30 p.m.

November 10 — Institution of Plant Engineers. Manchester Branch. Engineers' Club, Albert Square. "Oil Firing of Industrial Boilers." By Dr. H. A. Cheetham. 7.15 p.m.

November 10—Institute of Metals. South Wales Local Section. Metallurgy Dept., University College, Singleton Park, Swansea. "Economics of Rolling Mill Layouts." W. F. Cartwright. 6.30 p.m.

November 11—Institute of Metals. 17 Belgrave Square, London, S.W.1. Conversazione (informal) in connection with Electron-Microscope Symposium. 7.30 p.m. (Tickets, price 6s. each.)

November 11 — Liverpool Metallurgical Society. Joint Meeting with the Institute of Welding (Liverpool Branch). Picton Library. "Welding in Warship Construction." W. R. Seward. 7.30 p.m.

November 11—Institution of Production Engineers. North Western Region. Preston Branch. The Accrington College of Further Education, Sandy Lane, Accrington, Lancs. "Metrology and Industrial Measurement." P. W. Harrison. 7.30 p.m.

November 11—Institute of Metal Finishing. Organic Finishing Group. British Institute of Management, 80 Fetter Lane, London, E.C.4. "Pre-Treatment Methods and Choice for Organic Finishing." D. H. Lloyd and N. J. Heslop. 6.30 p.m.

November 11—Manchester Metallurgical Society. Manchester Room of The Central Library, Manchester. "Bearing Metals." P. F. Forrester. 6.30 p.m.

November 12—Birmingham Metallurgical Society (Inc.). Joint Meeting with Birmingham Local Section of The Institute of Metals. College of Technology, Gosta Green, Birmingham, 4. "Recent Corrosion Studies on Titanium." J. B. Cotton. 6.30 p.m.

November 12 — Institute of Metals. Royal Institution, Albemarle Street, London, W.1. Symposium on "The Application of Thin-Film Techniques to the Electron-Microscopic Examination of Metals." Arranged by the Metal Physics Committee. 9.30 a.m. and 2.15 p.m.

November 12—East Midlands Metallurgical Society. The Central Electricity Showrooms, Arkwright Street, Nottingham. "Metals in Storage Batteries." C. J. Bushrod. 7.30 p.m.

November 12 — Leeds Metallurgical Society. Metropole Hotel, Leeds. "Aluminium Casting Alloys and Foundry Practice." W. L. Bolton. 6.30 p.m.

Men and Metals

We are informed by Air Control Installations Ltd. that **Mr. D. G. Hill** has been appointed manager of the air filter department. Mr. Hill has been with the company for over 12 years and was trained in the company's works, serving in several departments before being appointed assistant manager of the filter department some 18 months ago.

News from The General Electric Company Limited is that **Mr. T. B. O. Kerr** has been appointed director for finance and administration. He was formerly a director and secretary of the company. Other appointments include those of **Mr. O. W. Humphreys** as director for research and technical development, and **Mr. W. J. Bird** as director for sales and marketing development.

Having reached retirement age, **Mr. G. W. Child,** a director of The London Electric Wire Company and Smiths Limited, is resigning from the board at the end of this year. Mr. Child has been in the service of the company since 1936, and has for many years been general manager of the company's Salford and Trafford Park works.

It is understood that **Mr. J. K. Vaughan-Morgan,** M.P., has rejoined the board of the Morgan Crucible Company Limited.

News from Wickman Limited is that **Mr. R. J. Dixon** has been appointed director and general manager of their machine tool manufacturing company.

Director of the British Steel Castings Research Association, **Dr. A. H. Sully** has been invited to present a Paper on "The Control of Dust and Noise in Steel Foundries" to the Technical and Operating Conference of the Steel Founders' Society of America, taking place in Cleveland, Ohio, next week. During his tour, Dr. Sully will visit a number of steel foundries and research centres in the U.S.A. and Canada.

Chairman of the Dunlop Rubber Company Limited, **Lord Baillieu** was elected first President of The British Institute of Management at the annual general meeting held in London recently.

In place of **Mr. J. C. Greig,** who has resigned, **Mr. John Harrison** has been appointed managing director of Atlas Copco (Great Britain) Limited. He has been with the Atlas Copco group of companies for some six years. He joined the group in 1953 and shortly afterwards was given the task of setting up the Cyprus company, which he ran as managing director from 1953 to 1957.

It is learned from New York that **Mr. N. R. Crump,** President of the Canadian Pacific Railway Company, has been elected a director of the International Nickel Company of Canada Limited.

Metal Market News

LAST week was again an interesting and even exciting spell on the market, but price movements were more restrained although the tendency was still upwards. The background remained much as before except that on Friday there appeared to be a feeling that a settlement of the Braden strike was imminent. Business sentiment in this country continues to be good, and many shares appreciated in value on the Stock Exchange, industrials being very much to the fore. Estimates of how much copper production has been lost to the world since the beginning of the American strike, now in its third month, vary, but it cannot be much less than 200,000 tons. On Thursday, news was received in London that the White Pine property had struck, the production affected being about 3,500 tons monthly. On the same day, it was reported that there was some labour unrest at Mufulira, but this was resolved within 24 hours. At the end of the week a settlement was reached in the tugmen's strike at Liverpool, and at the same time it was learnt that there had been an explosion at an important plant of American Metal Co. which would put the convertor out of action. Earlier in the week, Washington issued a denial of any intention to release copper from the stockpile and this, of course, operated as a bull point on the market. L.M.E. stocks were reported down again by 993 tons to 9,450 tons, and as we write the expectation is that further reductions will follow.

From the foregoing it will be seen that the copper market was subjected to many varying factors, some pulling one way and some another, but the balance was calculated to put the market up rather than down. The backwardation persisted, and at one time reached £19, while the top of the rise came in midweek, when cash stood at £265 10s. 0d. and three months at £248. On the following day, Thursday, however, a spasm of weakness struck the market, and in the second ring of the midday session there was a sudden and very sharp break, cash falling by £9 10s. 0d. and three months by £6 5s. 0d. It was reported that there was influential selling of near dates, which precipitated a wave of general selling. The Kerb was steadier, and Friday saw a further improvement so that the week ended with cash at £260 and three months at £246 10s. 0d., the backwardation, therefore, being £13 10s. 0d. The turnover for the week was about 13,600 tons. On balance cash gained £4 and forward gained £3.

The future course of values must depend on the duration of the strikes, but the general surmise is that we shall not see the market established at a lower level until the present disputes are settled. Even then, weeks and weeks must elapse before the supply situation becomes anything like normal, for a tremendous amount of copper has been lost. During the week a report from Salisbury suggested that R.S.T. was unlikely to make any increase in output during the second half of the year. Tin was not very active, the turnover being about 800 tons. The close was £794 10s. 0d. for cash and £796 10s. 0d. three months, the forward price being 30s. up. Stocks rose by 190 tons to 7,850 tons. Lead was up 15s. for October at £71 10s. 0d. and January 12s. 6d. up at £72 5s. 0d. The turnover was 7,200 tons. The squeeze for second half October zinc continued with a rise of £3 15s. 0d. to £98. January closed £2 higher at £92 15s. 0d. The turnover was 6,200 tons.

Birmingham

With the motor trade aiming at even higher output during the next twelve months, the prospects for industry in the Midlands are decidedly rosy. Some strain is being put upon the suppliers of raw materials and components. This is particularly noticeable in sheets, but it is likely that easier conditions will prevail before long as more plant is brought into operation. The building trade has been enjoying much more active conditions and there has been a better demand for builders' and plumbers' brassfoundry. More work is being done in non-ferrous pressings and castings. There has been an increase in sales of domestic hardware equipment. The Midland Region shares with London and the South-East the lowest percentage unemployment rate for October at 1·1. The biggest fall in the country has been in the West Midlands.

More iron and steel is being produced to meet the rapidly expanding demands of industry. The steel re-rolling mills are busier than they have been for at least eighteen months, and there are good orders for reinforcing bars for the building trade and small sections. The heavy steel mills are getting more orders, and in some instances delivery dates are being extended. Many of the foundries are benefiting from the prosperity in the motor trade and there is a substantial demand for low phosphoric pig iron. Output of this grade has increased steadily over the past two or three months.

One of the Midland companies is reported to be interested in a new company, to be known as Tower Aluminium (Nigeria), which has been formed for the purposes of manufacture and sale of Tower Brand aluminium hollow ware. Finance for the new company is being provided by the Midland Metal Spinning Company of Wolverhampton, which will have a controlling interest, by Aluminium Limited of Canada, and by Nigerian capital.

New York

Commodity Exchange copper, after early easiness reflecting the decline in London, rallied on news that the White Pines Copper Company had struck, and that the production of 3,500 tons of copper monthly would be lost. Dealer copper continued firm. Spot was still 39½ cents per lb., November delivery 39 and December 38½ cents per lb. Some business was done at these levels.

Zinc was quiet. Two sellers were still quoting 13 cents, but no sales were reported at that level. Lead was quiet. Tin was quiet and steady.

Mr. Leo A. Hoegh, director of the Office of Civil and Defense Mobilization (O.C.D.M.), issued a directive last week authorizing General Services Administration (G.S.A.) to buy three materials for the United States national stockpile. Under the directive, which would govern buying of materials for the stockpile for the remainder of the fiscal year ending on June 30, 1960, G.S.A. was authorized to make open market purchases from United States production of jewel bearings, small diamond dies and chrysotile asbestos, Mr. Hoegh said.

In addition, the directive authorized G.S.A. to upgrade a small amount of tungsten and molybdenum now in the stockpile of tungsten carbide powder and molybdic oxide. The upgrading would be done by U.S. firms. None of the procurement or upgrading would involve materials from offshore sources. In the announcement, Mr. Hoegh said the small number of items to be procured for the fiscal year 1960 "reflects the fact that basic objectives have been reached for almost all of the strategic materials in the national stockpile".

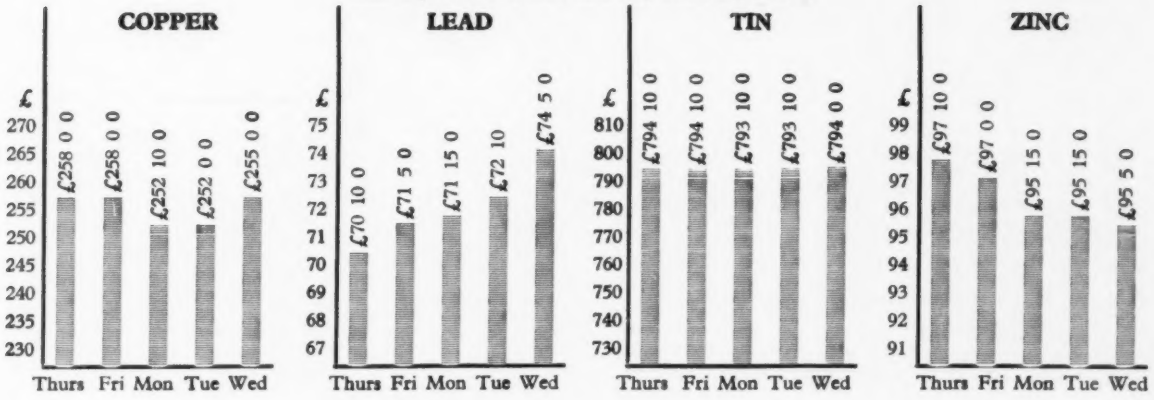
Tasmania

It was announced this week by the Tasmanian Premier, Mr. Eric Reece, that negotiations between the Tasmanian Government and the Broken Hill (Proprietary) Company Limited had resulted in a decision to establish an electro-metallurgical industry at Bell Bay, on the Tamar River. Mr. Reece said a 280-acre site would adjoin the plant of the Australian Aluminium Production Commission at Bell Bay. At first the new factory would produce ferromanganese for steel making. Capital outlay for the first stage would be about A£1,660,000.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 29 October to Wednesday 4 November 1959



Primary Metals

All prices quoted are those available at 2 p.m. 4/11/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite	per unit		—	
Copper H.C. Electro	ton	255	0	0
Fire Refined 99·70%	„	254	0	0
Fire Refined 99·50%	„	253	0	0

		£	s.	d.
Copper Sulphate	ton	80	0	0
Germanium	grm.		—	
Gold	oz.	12	10	2
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	74	5	0
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	245	0	0
Mercury	flask	72	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	7	5	0
Platinum	„	28	10	0
Rhodium	„	41	0	0
Ruthenium	„	18	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	8½
Tellurium	lb.		15	0
Tin	ton	794	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	93	2	6
Dust 95/97%	„	126	0	0
Dust 98/99%	„	132	0	0
Granulated 99+%	„	118	2	6
Granulated 99·99+%	„	135	0	0

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏£/ton	**Canada** c/lb ≏£/ton	**France** fr/kg ≏£/ton	**Italy** lire/kg ≏£/ton	**Switzerland** fr/kg ≏£/ton	**United States** c/lb ≏£/ton
Aluminium		22.50 185 17 6	224 168 0	375 221 5	2.50 212 10	26.80 214 10
Antimony 99.0			230 171 10	445 262 10		29.00 232 0
Cadmium			1,300 975 0			130.00 1,040 0
Copper						
Crude				500 295 0		
Wire bars 99.9						
Electrolytic	34.25 252 2 6	30.00 248 0 0	361 270 17 6		3.00 255 0	31.00 248 0
Lead		10.75 88 12 6	103 77 5	165 97 5	.88 74 17½6	13.00 104 0
Magnesium						
Nickel		70.00 578 5	900 675 0	1,200 708 0	7.50 637 10	74.00 592 0
Tin	110.75 817 2 6		1,120 840 0	1,500 885 0	9.75 828 17 6	101.62 812 17 6
Zinc						
Prime western		12.75 105 7 6				
High grade 99.95		13.25 109 5 0				
High grade 99.99		13.75 113 12 0				
Thermic			132.00 99 0 0			
Electrolytic			140.00 105 0 0	209 123 7 6	1.20 102 0	14.00 112 0

D

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 4/11/59

		£	s.	d.
Aluminium Alloy (Virgin)				
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0
Aluminium Alloys (Secondary)				
B.S. 1490 L.M.1	ton	152	0	0
B.S. 1490 L.M.2	„	162	0	0
B.S. 1490 L.M.4	„	178	0	0
B.S. 1490 L.M.6	„	188	0	0
***Aluminium Bronze**				
BSS 1400 AB.1	ton	251	0	0
BSS 1400 AB.2	„	261	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 65/35	ton	166	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„	217	0	0
***Gunmetal**				
R.C.H. 3/4%	ton		—	
(85/5/5/5) LG2	„	207	0	0
(86/7/5/2) LG3	„	217	0	0
(88/10/2/1)	„	259	0	0
(88/10/2/½)	„	272	0	0
***Manganese Bronze**				
BSS 1400 HTB1	„	199	0	0
BSS 1400 HTB2	„	215	0	0
BSS 1400 HTB3	„	228	0	0
Nickel Silver				
Casting Quality 12%	„	245	0	0
„ „ 16%	„	250	0	0
„ „ 18%	„	270	0	0
***Phosphor Bronze**				
B.S. 1400 P.B.1. (A.I.D. released)	„	305	0	0
B.S. 1400 L.P.B.1	„	226	0	0

** Average prices for the last week-end.*

		£	s.	d.
Phosphor Copper				
10%	ton	267	0	0
15%	„	269	0	0
Phosphor Tin				
5%	„		—	
Silicon Bronze				
BSS 1400-SB1	„	275	0	0
Solder, soft, BSS 219				
Grade C Tinmans	„	369	10	0
Grade D Plumbers	„	297	10	0
Grade M	„	405	15	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 „	„		—	
Zinc Alloys				
B.S.S.1004 Alloy A	ton	128	5	0
B.S.S.1004 Alloy B	„	132	5	0
Sodium-Zinc	lb.		2	8½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

		£	s.	d.
Aluminium				
Sheet 10 S.W.G.	lb.		2	8½
Sheet 18 S.W.G.	„		2	10½
Sheet 24 S.W.G.	„		3	1½
Strip 10 S.W.G.	„		2	8½
Strip 18 S.W.G.	„		2	9½
Strip 24 S.W.G.	„		2	11
Circles 22 S.W.G.	„		3	2½
Circles 18 S.W.G.	„		3	1½
Circles 12 S.W.G.	„		3	0½
Plate as rolled	„		2	8
Sections	„		3	2
Wire 10 S.W.G.	„		2	11½
Tubes 1 in. o.d. 16 S.W.G.	„		4	1
Aluminium Alloys				
BS1470. HS10W.				
Sheet 10 S.W.G.	„		3	1
Sheet 18 S.W.G.	„		3	3½
Sheet 24 S.W.G.	„		3	11
Strip 10 S.W.G.	„		3	1
Strip 18 S.W.G.	„		3	2½
Strip 24 S.W.G.	„		3	10½
BS1477. HP30M.				
Plate as rolled	„		2	11
BS1470. HC15WP.				
Sheet 10 S.W.G.	„		3	9½
Sheet 18 S.W.G.	„		4	2
Sheet 24 S.W.G.	„		5	0½
Strip 10 S.W.G.	„		3	10½
Strip 18 S.W.G.	„		4	2
Strip 24 S.W.G.	„		4	9½
BS1477. HPC15WP.				
Plate heat treated	„		6	3½
BS1475. HG10W.				
Wire 10 S.W.G.	„		3	10½
BS1471. HT10WP.				
Tubes 1 in. o.d. 16 S.W.G.	„		5	0½
BS1476. HE10WP.				
Sections	„		3	1½
Brass				
Tubes	„		2	0½
Brazed Tubes	„		3	2½
Drawn Strip Sections	„		3	2⅞
Sheet	ton	218	10	0
Strip	„	218	10	0
Extruded Bar	lb.		2	2½
Extruded Bar (Pure Metal Basis)	„		—	

		£	s.	d.
Brass				
Condenser Plate (Yellow Metal)	ton	210	0	0
Condenser Plate (Naval Brass)	„	222	0	0
Wire	lb.		2	9⅞
Beryllium Copper				
Strip	„	1	4	11
Rod	„	1	1	6
Wire	„	1	4	9
Copper				
Tubes	lb.		2	5½
Sheet	ton	283	15	0
Strip	„	283	15	0
Plain Plates	„		—	
Locomotive Rods	„		—	
H.C. Wire	„	310	5	0
Cupro Nickel				
Tubes 70/30	lb.		3	8¾

		£	s.	d.
Lead				
Pipes (London)	ton	111	5	0
Sheet (London)	„	109	0	0
Tellurium Lead	„	£6 extra		
Nickel Silver				
Sheet and Strip 7%	lb.		3	10½
Wire 10%	„		4	5½
Phosphor Bronze				
Wire	„		4	3
Titanium (1,000 lb. lots)				
Billet 4½″ to 18″ dia.	lb.	54/-		55/-
Rod ½″ to 4″ dia.	„	95/-		62/-
Wire ·036″-·232″ dia.	„	167/-		110/-
Strip ·003″ to ·048″	„	200/-		75/-
Sheet 8′ × 2′. 20 gauge	„	85/-		
Tube, representative average gauge	„	300/-		
Extrusions	„	105/-		
Zinc				
Sheet	ton	130	15	0
Strip	„	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 3/11/59.

	£
Aluminium	
New Cuttings	150
Old Rolled	132
Segregated Turnings	104
Brass	
Cuttings	176
Rod Ends	162
Heavy Yellow	130
Light	124
Rolled	166
Collected Scrap	126
Turnings	155
Copper	
Wire	230
Firebox, cut up	215
Heavy	213
Light	205
Cuttings	230
Turnings	206
Braziery	172
Gunmetal	
Gear Wheels	185
Admiralty	185
Commercial	175
Turnings	170
Lead	
Scrap	61
Nickel	
Cuttings	—
Anodes	550
Phosphor Bronze	
Scrap	175
Turnings	170
Zinc	
Remelted	86
Cuttings	71
Old Zinc	50

Financial News

McKechnie Brothers Ltd.

Accounts to July 31 last show group profits at £943,834 (£527,609) and, after taxation net profit is shown at £617,051 (£246,607). In addition to maintaining the 15 per cent dividend for the year the directors announce a special 5 per cent tax-free distribution out of non-taxable profits. Taken to general reserve is £190,814 (£60,290).

An Amalgamation

It has been announced that Hilger and Watts Ltd. have acquired the whole of the issued share capital of the Infra-Red Development Company Ltd., of Welwyn Garden City. The latter company was founded in 1946 and has been under the technical control and management of Mr. W. B. Bartley, who will remain managing director. The pooling of knowledge and experience will be of great value to the two companies and the technical, financial and manufacturing resources of the Hilger and Watts organization will expedite further developments in gas analysis and their application in the field of process control. The Infra-Red Development Co. Ltd. will continue to operate at its works and offices in Welwyn Garden City.

Tube Investments Ltd.

Preliminary results of the group for the year ended July 31 last show a net profit for the year at £6,458,460 (£6,003,420). Reserves and carry forward are shown at £4,227,201 (£4,356,053). The directors recommend a final dividend on the Ordinary Stock of 12½ per cent making a total for the year of 20 per cent.

Minworth Metals

Group profit for the year to July 31 last is shown at £66,786 (£42,024), after tax of £62,196 (£53,308). Dividend recommended of 30 per cent and it is proposed to make a one-for-two scrip issue.

W. and J. Lawley

Dividend of 25 per cent for the year ended July 31, 1959 (same). Group net profit £45,200 (£39,429), after tax £42,097 (£47,997). Add taxation over-provided £4,429 (£1,018). Dividend takes £18,375 (£17,250), and general reserve £20,000 (£17,500). Forward £68,731 (£57,477).

Birmid Industries

Accounts to July 1959 show group profits at £2,129,465 against £1,953,080 last year. After tax net profit is £1,077,938 (£989,731). Proposed dividend for the year 20 per cent (17½ per cent).

British Aluminium Co. Ltd.

Consolidated trading profit seven months to July 31, 1959, £2,004,418 (£3,070,242 for year) and net balance, after minority interests £689,388 (£1,024,058) after tax £681,106 (£1,180,024). Retained by subsidiaries £71,543 (£101,985), available for parent £617,845 (£922,073, plus £201,000 from stock reserve). Dividend, as stated October 9, is 5 per cent for the period (17½ per cent for year). Fixed assets £27,152,886 (£26,157,557), including interests in associated companies, less written off, £5,489,751 (£4,483,070) and investment in Canadian British Aluminium Company, less current accounts of £7,653,949 (£7,664,592). Current assets £16,051,146 (£16,847,796), including cash £489,872 (£933,424) and Government securities £63,222 (£62,784 and tax certificates £1,850). Current liabilities £6,420,042 (£6,190,550), including due to bankers £817,187 (£265,714) and bills discounted under acceptance credit £1,684,833 (£1,014,808). Authorized capital expenditure £738,000 (£722,000) and commitments outstanding £413,381 (£470,104).

Union Minière

Announcing an unchanged interim of 600 francs free of tax, Union Minière du Haut-Katanga say that industrial operations continue to be very satisfactory and were not affected by the political situation prevailing in the Congo this year. Efficiency of work was excellent and copper output for the financial year will probably reach 270,000 metric tons compared with 235,500 tons in 1959 and a previous maximum of 247,500 tons in 1956. New construction work is progressing according to schedule, the company added.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (francs per kilo):

Electrolytic copper scrap	(£217.12.6)	290
Heavy copper	(£217.12.6)	290
No. 1 copper wire	(£202.10.0)	270
Brass rod ends	(£146.5.0)	195
Zinc castings	(£56.2.6)	75
Lead	(£69.0.0)	92
Aluminium	(£135.0.0)	180

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£200.15.0)	340
Lead, soft, first quality	(£126.0.0)	135
Lead, battery plates	(£45.0.0)	76
Copper, first grade	(£233.0.0)	395
Bronze, commercial gunmetal	(£188.17.6)	320
Brass, heavy	(£162.5.0)	275
Brass, light	(£147.12.6)	250
Brass, bar turnings	(£150.10.0)	255
Old zinc	(£56.0.0)	95

Japan (Yen per metric ton):

Electrolytic copper	(£—)	303,000
Copper wire No. 1	(£—)	277,000
Copper wire No. 2	(£—)	245,000
Heavy copper	(£—)	265,000
Light copper	(£—)	235,000
Brass, new cuttings	(£—)	205,000
Red brass scrap	(£—)	218,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£223.7.0)	255
Heavy copper	(£219.0.0)	250
Light copper	(£188.7.6)	215
Heavy brass	(£131.10.0)	150
Light brass	(£97.5.0)	111
Soft lead scrap	(£59.17.6)	68
Zinc scrap	(£48.2.6)	55
Used aluminium unsorted	(£105.2.6)	120

Trade Publications

Electrical Products.—The English Electric Company Limited, Stafford.

Six new publications have recently been distributed by this company. These cover respectively: steam turbines, marine steam turbines, gas turbines, diesel engines, induction motors, and high clip, high torque motors.

Surface Grinding Machine.—A. A. Jones and Shipman Ltd., Narborough Road South, Leicester.

A coloured eight-page brochure gives details of the company's Model 1400 surface grinding machine which is now fitted with power rise and fall to the wheelhead as a standard feature. Automatic down feed to the wheelhead is available as an optional feature.

Oil Producing and Refining —Petroleum Information Bureau, 29 New Bond Street, London, W.1.

The Bureau has published the 1959 edition of its wall map indicating, by symbols, the relative importance of the world's oil producing and refining countries, together with statistics for 1958. The map, measuring 40 in. by 30 in., includes a diagram showing the sources of U.K. oil imports and a graph illustrating the remarkable growth of world oil production. Copies of this map are available from the Bureau price 2s. each, post free.

Dust Collection —W. C. Holmes and Co. Ltd., Turnbridge, Huddersfield.

A recently produced publication (No. 81) describes the Holmes-Rothemuhle multi-cell cyclone and cyclone dust collectors. This new unit is described in detail and graphs, illustrations and diagrams are also included.

Titanium Wrought Products. — Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1.

The first of a series of five booklets to be published by the Metals Division of I.C.I., covers 16 pages and is of a general introductory nature. It describes the company's manufacturing facilities and production range, and indicates the principal outlets for titanium and titanium alloys. In addition to technical data a number of interesting photographs are also included.

LIGHT METALS STATISTICS IN JAPAN (July, 1959)

Classification	Production	Shipment	Stock	Export
Alumina	25,606	18,229	16,028	50
Aluminium				
Primary	8,871	8,919	1,227	0
Secondary	3,148	3,101	422	0
Rolled Products	8,157	8,147	1,796	580
Electric Wire	1,256	1,105	588	27
Sheet Products	1,548	1,567	1,348	91
Castings	2,204	—	—	—
Die-Castings	1,500	—	—	—
Forgings	35	—	—	—
Powder	—	—	—	—
Primary Aluminium (August)	8,588	8,462	1,354	0
Sponge Titanium	233	196	864	167
Magnesium	121	103	18	0
Secondary	268	276	137	0

THE STOCK EXCHANGE

Turnover Well Maintained But Prices Occasionally Below Best

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 2 NOVEMBER +RISE — FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	32/3 +3/3	9	9	5 11 6	32/3	23/3	24/9	17/6
400,000	2/–	Anti-Attrition Metal	1/3	4	8½	6 15 0	1/6	1/3	1/9	1/3
41,303,829	Stk. (£1)	Associated Electrical Industries ...	64/9 —2/–	15	15	4 12 9	67/–	54/–	58/9	46/6
1,613,280	1	Birfield	69/– —1/–	15	15	4 7 0	75/–	46/9	62/4½	46/3
3,196,667	1	Birmid Industries	105/– +5/6	17½	17½	3 6 9	108/9	72/–	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	63/– +4/9	11	10	3 9 9	63/3	36/1½	39/–	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/9	5	5	6 7 0	16/3	15/–	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	18/7½	6	6	6 8 9	18/10½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	40/– +5/6	10	10	5 0 0	40/–	27/6	28/9	24/–
300,000	1	Ditto Pref. 5%	15/–	5	5	6 13 3	15/6	14/–	16/–	15/–
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6	7	7	6 16 6	20/6	20/–	20/4½	19/–
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	19/9	6	6	6 1 6	20/7½	18/9	20/–	18/4½
17,247,070	Stk. (£1)	British Insulated Callender's Cables	54/– —4/6	12½	12½	4 12 6	61/–	46/3	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	79/– +2/6	10	10	2 10 9	79/–	49/3	52/–	28/3
1,200,000	Stk. (5/–)	Canning (W.) & Co.	16/–xd	25+ *2½C‡	25	3 18 0	16/–	12/3	25/3	19/3
60,484	1/–	Carr (Chas.)	2/–	12½	25	6 5 0	2/10½	1/3	2/3	1/4½
555,000	1	Clifford (Chas.) Ltd.	26/3	10	10	7 12 6	27/–	22/6	22/–	16/–
45,000	1	Ditto Cum. Pref. 6%	16/9	6	6	7 3 3	17/–	15/3	16/–	15/–
250,000	2/–	Coley Metals	3/6 +6d.	15	20	8 11 6	4/–	2/10½	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	74/6	15	18¾	4 0 6	75/9	59/–	65/3	41/–
1,509,528	1	Davy & United	98/6 —3/–	30‡	20	3 1 0	102/–	43/1½	87/–	45/9
6,840,000	5/–	Delta Metal	22/– +2/1½	31‡	30	3 10 6	22/–	12/–	25/–	17/7½
5 296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	60/–	15	12½	5 0 0	60/–	36/7½	38/–	22/9
750,000	1	Evered & Co.	35/9	10§	15D	5 11 9	35/9	30/–	30/–	26/–
18,000,000	Stk. (£1)	General Electric Co.	43/9 —2/–	10	10P	4 11 6	48/9	30/–	40/6	29/6
1,500,000	Stk. (10/–)	General Refractories Ltd.	45/3 +2/–	20	20	4 8 6	45/3	31/9	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	67/– +3/–	16½	15	4 18 6	67/–	63/–	67/6	61/–
750,000	5/–	Glacier Metal Co. Ltd.	9/6 —3d.	11½	11½	6 1 0	9/9	6/7½	8/3	5/–
1,750,000	5/	Glynwed Tubes	25/9 +9d.	20¶	20	3 2 3	26/–	16/4½	18/1½	12/10½
5,421,049	10/–	Goodlass Wall & Lead Industries ...	49/6 +2/–	13‖	18D	2 12 6	49/6	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	110/– +5/–	30	20	5 9 0	110/–	75/–	57/9	45/–
396,000	5/–	Harrison (B'ham) Ord.	25/3 +9d.	*17½	*15	3 9 3	25/3	14/11½	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6	7	7	7 3 6	19/6	19/3	19/9	18/4½
1,075,167	5/–	Heenan Group	14/9 +1/6	10	10‡	3 7 9	14/9	7/6	9/7½	6/9
246,209,422	Stk. (£1)	Imperial Chemical Industries ...	54/9 +1/–	12 DZ	10	2 18 6	56/6	33/9	38/–	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	18/9 +6d.	5	5	5 6 9	18/9	16/–	17/1½	16/–
14,584,025	**	International Nickel	178 +3	$2.60	$3.75	2 12 0	187¾	154½	169	132¾
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3	5	5	6 3 0	16/3	15/4½	16/9	15/–
6,000,000	1	Ditto Ord.	47/3 +2/9	12D	10	3 7 9	47/3	29/7½	47/–	36/6
600,000	10/–	Keith, Blackman	31/3	17½E	15	4 7 0	31/3	25/–	28/9	15/–
320,000	4/–	London Aluminium	7/– +4½d.	10	10	5 14 3	8/3	5/3	6/–	3/–
765,012	1	McKechnie Brothers Ord.	63/9 +12/9	15	15	4 14 0	63/9	41/–	45/–	32/–
1,530,024	1	Ditto A Ord.	62/– +12/–	15	15	4 16 9	62/–	38/9	45/–	30/–
1,108,268	5/–	Manganese Bronze & Brass	18/6xd +7½d.	20§	20	5 12 6	18/6	13/9	14/1½	8/9
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–xd +1½d.	7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	76/– +2/6	11	11	2 18 0	80/–	44/7½	73/3	40/6
415,760	Stk. (2/–)	Metal Traders	11/6xd +1½d.	50	50	8 14 0	12/3	8/4½	9/–	6/3
160,000	1	Mint (The) Birmingham	30/– +1/–	10	10	6 13 3	30/–	22/–	22/9	19/–
80,000	5	Ditto Pref. 6%	80/–	6	6	7 10 0	75/6	69/–	83/6	69/–
5,187,938	Stk. (£1)	Morgan Crucible A	49/6xcap +2/6	10ϕ	10	2 17 9	49/6	43/6	45/–	34/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	18/–	5½	5½	6 2 3	18/6	17/6	18/–	17/–
2,200,000	Stk. (£1)	Murex	60/9 +4/–	15	17½	4 18 9	60/9	41/–	58/9	46/–
468,000	5/–	Ratcliffs (Great Bridge)	12/9xd	10R	10	3 18 6	12/9	9/6	11/1½	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	54/6 +6d.	25	20	4 11 9	54/6	27/9	27/3	24/6
1,365,000	Stk. (5/–)	Sarck	30/3xd +9d.	17½GB	15	2 17 9	30/3	18/–	18/7½	11/–
6,698,586	Stk. (£1)	Stone-Platt Industries	63/– +6d.	15	15	4 15 3	63/–	42/6	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	18/3 +6d.	5½	5½	6 0 6	18/3	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	117/– +8/–	17½	15	2 19 9	120/–	72/–	86/–	48/4½
41,000,000	Stk. (£1)	Vickers	31/9 +1/10½	10	10	6 6 0	37/–	27/4½	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	15/–	5	5	6 13 9	15/0¾	14/3	15/9	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	23/– +1/9	*5	*5	6 9 6A	23/–	20/6	23/–	21/3
2,200,000	1	Ward (Thos. W.), Ord.	141/3 —1/3	20	15	2 16 6	147/6	83/–	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	52/3	10	10	3 16 6	53/9	39/9	46/6	32/6
225,000	2/–	Wolverhampton Die-Casting ...	12/7½ —4½d.	30	25	4 15 0	13/3	8/8½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	30/–	27½	27½	4 11 9	32/6	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gall	7/1½	20	20	7 0 6	7/6	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/9	6	6	8 14 9	13/9	12/10½	13/–	11/3
150,000	1/–	Zinc Alloy Rust Proof	3/3 +1½d.	27	40D	8 6 0	3/9¾	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. D And 50% capitalized issue. C Paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. § And Special distribution of 2½% free of tax. R And 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. ¶ Interim since increased from 10% to 12%. ϕ And 40% capitalized issue. Z Interim since increased. B And proposed 50% capitalized issue. G And 1¾d. special distribution.

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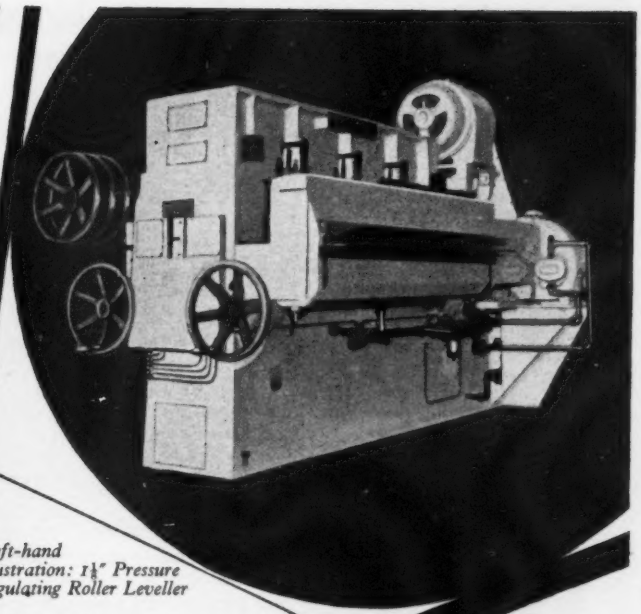
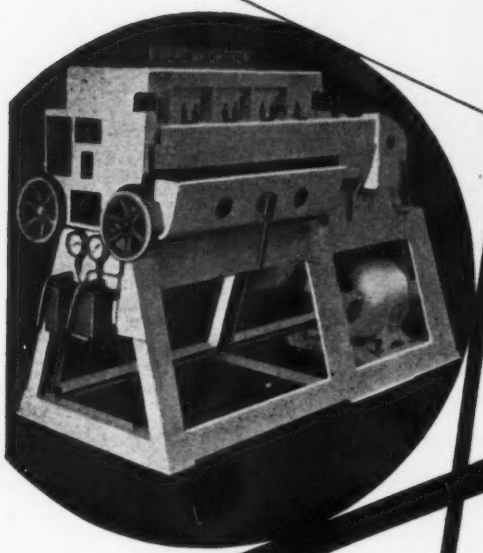
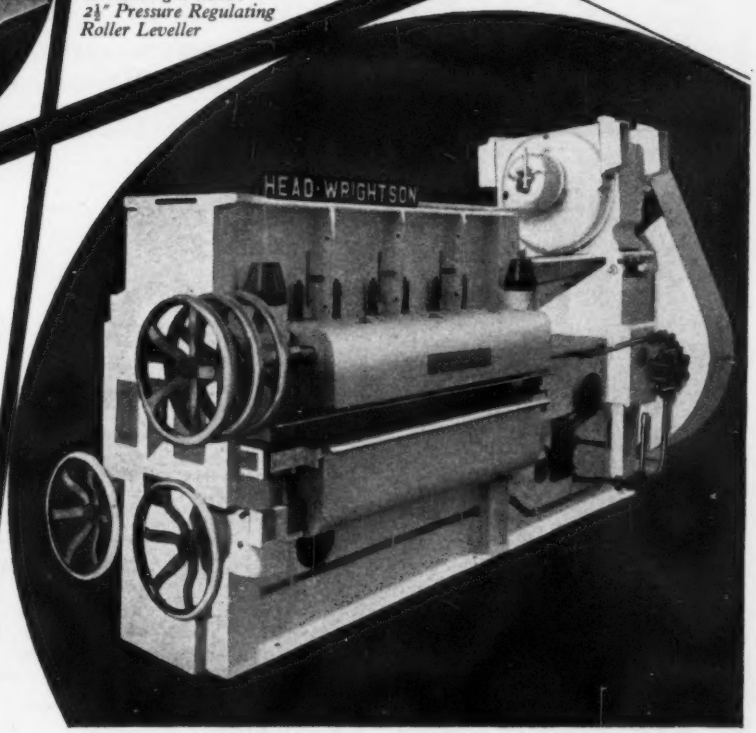




Left-hand illustration: 1½" Pressure Regulating Roller Leveller

Top right-hand: 1¾" Processor Leveller

Bottom right-hand: 2½" Pressure Regulating Roller Leveller



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Printed in Great Britain by James Cond Ltd., Charlotte Street, Birmingham, 3. Published by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.